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SIZE OF POTATO SETS: COMPARISONS OF WHOLE AND CUT SEED

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Office of Horticultural Investigations, Bureau of Plant Industry

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INTRODUCTION.

The influence of the size of the potato set upon the resultant crop has served as the basis of experimental study through several generations and has received a large share of attention from experiment-station investigators for more than 30 years, or since the establishment of these stations. It may seem strange, therefore, that a subject to which so much attention has been given should still remain a moot question as regards the advisability of planting whole seed or of using large tubers when cut seed is to be planted. Failure to arrive at a satisfactory agreement upon the use of whole or cut seed or even on the size of the set is attributable to a number of causes, the chief of which, it is believed, are the varying influences of temperature, moisture, and soil conditions during certain periods in the growth of the plant. Other conditions, such as the fertility of the soil and the cultural care given to the crop, are also extremely important factors. A critical study of the experimental data upon this question impresses one with the idea that in most of the investigations thus far reported the work has been performed upon a scale too small to justify any sweeping conclusions. In many instances no considera-

[1] The term "set" is used in this bulletin in preference to the term "seed piece" because it can be employed in a collective sense; that is, it applies equally well to both whole and cut seed. The term "seed piece," if strict adherence to its literal meaning is observed, can only be used for cut seed. The term "set" being a shorter and more inclusive word is therefore advocated for adoption. Another reason for its use is that it is almost universally employed by English writers in Great Britain and her colonies.

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tion has been given to the proper spacing of sets of different sizes in order to provide for a maximum yield from each on a given area of land.

The usual practice has been to space the sets in the row at such distance apart as was judged suitable for sets of average size. Under such conditions it is conceivable that large-sized sets or whole tubers were spaced too close together to permit their maximum development, while the wide spacing of small-sized sets permitted a maximum yield per plant but undoubtedly a lower yield for a given area of land.

It is self-evident that data obtained under such conditions may easily lead to erroneous conclusions regarding the relative value of sets of varying size. In fact, it is fair to assume that many of the discordant results that have been recorded from time to time are due to some of the causes mentioned. In comparing whole and cut seed, the element of moisture and an abundant supply of available plant food are important factors in determining yields. If either of these is lacking during the period in which the tubers are developing, the plants from whole seed as a rule will be most seriously affected. The whole tuber produces on an average a much larger number of stems and consequently a more numerous tuber progeny, many of which, unless well supplied with moisture and plant food, will not attain sufficient size to grade as table stock. The moisture supply during the period of germination may also have an important bearing on the relation of size and kind of seed to the stand. If there is a limited amount of moisture in the soil at the time of planting and immediately following, a small seed piece, especially if there is much cut surface permitting a considerable loss of water, may contain insufficient moisture and available food material to start the young plant and maintain its growth until it can derive its nourishment from the soil. Under favorable conditions for germination and growth the influence of the size of the set at this period of the plant's development is greatly minimized.

The use of whole tubers for seed purposes offers greater possibilities in irrigated than in nonirrigated regions, because where irrigation is possible the question of moisture supply during these critical periods is eliminated.

EARLY EXPERIMENTAL STUDIES.

Among the earlier recorded experimental studies bearing upon the relative value of whole seed and cut seed of large-sized and small-sized sets that have come to the attention of the writers are those by Anderson, (*7*, *8*)[2] Wimpey (*103*), Cochran (*27*), King (*56*, p. 92), Barrell (*12*), and Adams (*2*).

In 1776 Anderson compared small potatoes planted whole with medium potatoes cut in two. Small potatoes averaging 0.275 ounce in weight and small potatoes cut in two averaging 0.1875 ounce in weight were used. Large 1-eye sets from the basal part of large tubers averaging 0.13 ounce in weight and large whole tubers averaging 6.5 ounces from which all eyes but one had been removed were also used. The results of the season's study showed a slight increase in yield of the small whole potatoes over medium-sized tubers halved. Small

[2] Serial numbers (*italic*) in parentheses refer to "Literature cited," at the end of this bulletin.

whole potatoes of known average weight in comparison with halved tubers of known weight showed an increase in favor of the whole tubers of more than 37 per cent, while 1-eye sets from the apical and basal portions (seed and stem ends) of the tubers showed an increase of more than 123 per cent in favor of the basal-eye sets. As might be expected, the large whole tubers from which all but one eye had been removed outyielded the large 1-eye sets from the basal parts of large tubers. The increase in this case was nearly 49 per cent. One of Anderson's conclusions (*7*, p. 14) as a result of this study was "that the weight of the crop is always in some measure influenced by the weight of the seeds planted." In a later portion of his paper Anderson says (*7*, p. 27):

> Although it appears from the foregoing experiments that the weight of the crop was always greatest where the seeds planted were the most weighty, yet it would be too rash in us from thence to infer that as great a crop could in no case be obtained from the same extent of ground if it were planted with small potatoes or small cuttings as if it were planted with large ones. For it is possible that the more bulky seed would require a greater space to nourish them properly than small ones; so it is not impossible that if these small seeds were planted at a proportionally smaller distance the crop might equal that obtained from the larger ones.

The foregoing deductions by Anderson express a truism that has been apparently overlooked by many later investigators who have studied this subject.

Wimpey carefully selected 48 bushels of sets from a large quantity of seed. The tubers selected ranged in size from that of a large pullet's egg to that of a goose egg. Fourteen bushels were planted whole on 60 poles of land, or 0.375 acre; the remainder, 34 bushels, were cut and planted on 265 poles of land, or nearly 1.64 acres. The whole seed yielded 66 bushels and the cut seed 312 bushels. On the basis of area planted the whole seed should have yielded 70.64 bushels. Disregarding the larger quantity of whole seed used for a given area, the percentage of increase of cut seed over whole seed was only 7 per cent. If, however, the comparison is made on the basis of total yield minus the seed used, the cut seed outyielded the whole seed by more than 21 per cent. There is one feature of Wimpey's experiment which may have had something to do with the poorer showing made by the whole seed. He states in his paper that he cut the larger tubers, indicating that the smaller sized ones had been used in the whole-seed plat. This lack of uniformity in the size of the tubers in both cases probably exerted an influence on the resultant yield. Wimpey seems not to have thought it of sufficient importance to be worth considering.

Cochran studied the relative merits of large, medium, and small sized sets. His results support Anderson's deductions that the larger the set used, within reasonable limitations, of course, the larger the yield. The large sets yielded 280 pounds; the medium, 249.5 pounds; and the small, 168 pounds. As the weight of seed planted is not stated, the actual net yields can not be computed.

King says that "experience proves that the best seed (cuttings or sets) is to be had from the largest potatoes of every kind. A good set, part of a large potato, all other things equal, will naturally produce a stronger and better plant than part of a small potato."

Barrell obtained a very much greater yield from large than from small seed.

.Adams compared the relative productive capacity of 1-eye sets and of small and large whole tubers. The results showed a uniform increase in yield from the larger sets. The increase from the small whole tubers over the 1-eye set was equal to 72.7 per cent, while that from large whole tubers was 154.5 per cent. No data are given relative to the quantity of seed used; hence, no comparison can be made as to net yield.

Payen and Chevallier (*67*) on a rather small scale compared the relative behavior of medium and small whole tubers, cut seed, potato parings, and eyes of six tubers. The respective yields were 6.5, 6.1, 5.59, 0.5, and 0.4 kilograms.

A rather careful and fairly comprehensive study of the relative merits of whole seed and cut seed by Lindley (*61*) in 1832, reported to the Horticultural Society of London in 1834, showed that, on the whole, better results were obtained from cut seed than from whole seed. Lindley says (p. 453) that "it would therefore appear . . . that the opinion which has been entertained of the superior productiveness of tubers over sets is unfounded, a conclusion to which Sir George Mackenzie has also come from experiments made by him in Ross-shire." This conclusion was conveyed to Lindley in a letter dated December 10, 1833. In commenting on this paper (*61*, p. 455), Thomas Andrew Knight says that from the results of his experiments and observations he had come to the conclusion "that the heaviest crops of potatoes, and those most profitable to the grower, will, in most soils and seasons, be obtained from tubers of considerable weight, and I have preferred whole tubers because I have found those least subject to decay in wet and cold springs." A specific instance is cited by Knight in which a rather poor piece of land was divided into two plats of equal size that were planted with whole seed and cut seed, respectively. None of the whole tubers weighed less than 4 ounces. A heavy yield was obtained from the whole-tuber plat and a very meager one from the cut seed. No information is given concerning the size of the cut seed.

In a later communication to the society, Lindley (*61*, p. 524–528) presents some further data on whole and cut seed and different spacings. His conclusion, based on the results secured, is as follows:

> I think this result is the most interesting that we have yet obtained, for it not only reduced to something like a demonstration the superiority of sets over whole tubers, but it shows that the crop will be greater where the distance between the rows is most in accordance with the average height of the potato stems.

In December, 1836, Thompson (*98*) communicated the results of some studies he had made relative to the time of planting, size of sets, and depth of planting. Whole tubers were compared with the apical and basal parts of the tuber. Two plantings were made, the first week in March and the first week in April. The early planted plats showed a greater net yield—that is, after deducting the seed used from the apical sets; the basal sets came next; and the whole-tuber sets last. Different results were obtained from later planted plats. In this trial the whole tubers gave the largest yield, the apical sets next, and the basal ones the lowest.

Sanborn (*80*) compared the relative merits of 1-eye, 2-eye, and 3-eye sets, seed-end and stem-end pieces, and small and large whole tubers. His results show that the yields were not in accordance with the size of the seed planted, as the seed-end pieces or sets from the apical

end of the tuber gave an increase over 1-eye cuttings, the ratio between the two yields being as 1 to 3, or an increase of slightly over 200 per cent. The second largest yield was from stem-end pieces, the increase being 127.4 per cent. Whole small tubers ranked third, 3-eye pieces fourth, large whole tubers fifth, and 2-eye sets sixth. No information is given as to the reason for the poor showing made by the large whole tubers.

Sturtevant (*94*) in 1882, after a careful study of whole seed and cut seed, expressed his belief that properly cut single-eye pieces were superior to whole tubers for seed purposes.

Roberts (*77*) compared the relative merits of 1-eye sets cut from seed end to stem end with those cut from stem end to seed end and with whole medium-sized tubers. He obtained the largest yield from the whole seed. The sets cut from stem end to seed end gave the next largest yield.

In 1886 Alwood (*6*, p. 70–71) reported the results of a comparative test of whole and cut seed in which the whole seed very greatly outyielded the cut seed. He submitted the data shown in Table 1.

TABLE 1.—*Comparative test of whole and cut seed potatoes reported by Alwood in 1886.*

Kind of seed.	Average yield of tubers (bushels).		
	Merchantable.	Unmerchantable.	Total.
Whole seed	239.6	106.5	346.1
Ordinary cuts, two eyes	205.2	35.3	240.5
One-eye cuts	111.8	8.8	120.6
One-eye reversed (cuts from the stem to the seed end)	175.1	11.6	186.7

Investigations by Johnson (*52*, p. 7–8) at the Michigan station regarding the value of whole and cut seed seem to indicate that large-sized cut seed is superior to whole seed, at least when the comparison is made on the basis of merchantable tubers. In 1888 a further report was made by Johnson (*53*) in which results dissimilar to those reported in 1886 are noted. In this case the comparative merits of whole 3-eye, 2-eye, and 1-eye sets were studied. The results show an increase in yield uniform with the increase in the size of the set.

Goff's studies of the size of sets extended over a number of years. In the first report (*39*, p. 150) whole tubers gave a larger yield than cut seed, but as no information is given as to the actual quantities of seed planted it is not clear whether the net yield was greater or not. The data given in the 1887 report (*40*, p. 87) are slightly in favor of halved tubers, the yield of merchantable tubers from the whole seed being at the rate of 447.5 bushels and that from halved tubers 454 bushels per acre. The total yield, however, was slightly in favor of whole seed, 538 bushels as against 533.5 bushels. In the 1888 report (*41*, p. 164–165) Goff's data show that the average of 12 tests with 1-eye, 2-eye, 3-eye, halved, and whole tubers were in favor of cut seed. The increase of cut seed over whole seed was at the rate of 78.5 bushels per acre. The 1889 report (*42*) shows a larger yield of merchantable tubers from 2-eye sets than from whole or halved tubers, but the total yield was greatest from whole seed.

In Minnesota, Porter (*71*) found that quartered seed ends of large tubers gave a larger yield than 2-eye sets from large tubers, whole seed, or quartered stem ends. The quartered seed gave a net yield of 286.4 bushels per acre, the 2-eye sets 263.8 bushels, the whole seed 224.3 bushels, and the quartered stem ends 223.4 bushels.

Scovell (*83*, p. 9–10) made a comparative study of 2-eye sets and small and large whole tubers. The large whole seed yielded at the rate of 260 bushels per acre, the small whole 193 bushels, and the 2-eye sets 150 bushels. In 1888 Scovell and Peter (*84*, p. 8–9) reported larger net yields from small whole tubers than from large ones or from cut seed. The yields in all cases were very low, however, and little reliance should be placed on these results.

Alvord (*5*, p. 24) obtained larger yields from egg-sized whole tubers than from sets of ordinary size or from single eyes. The average yields during the years 1885, 1886, and 1888 were 281.5 bushels per acre from the whole tubers, 191 bushels from the ordinary sets, and 128.6 bushels from the single-eye sets.

In 1889 Green (*43*) published the results of some comparative studies upon the relative value of whole and cut seed. The test included (1) large whole tubers, (2) large tubers from which all but two eyes were removed, (3) large tubers halved lengthwise, (4) apical halves of large tubers, (5) basal halves of large tubers, (6) basal halves quartered, (7) apical halves quartered, (8) 2-eye sets, (9) small tubers cut crosswise, and (10) small tubers cut lengthwise. The data show that in yield of merchantable tubers 3 and 4 were tied for first place with others following in the order named: 10, 2, 1, 5, 8 and 9 tied, 7, 6. In total yield the order was 4, 3, 1, 5, 10, 9, 8, 2, 6, 7. The conclusions to be drawn are that in this particular test halved tubers gave larger yields than whole ones.

Bishop (*15*, p. 63) says that "there is no evidence to prove that there is any advantage in planting sets of large potatoes instead of small ones or even whole small tubers of equal weight with the former."

Garman's (*55*, p. 15) conclusions from a three years' study of size of set were that large whole potatoes gave better yields than cut seed. These conclusions are directly reversed by Johnson (*54*, p. 6), who states that a medium quantity of seed is better than a whole potato or one cut to single eyes. Emery (*32*) in 1890 published the results of tests of whole and cut seed covering three years in which the data were distinctly in favor of whole egg-size potatoes as compared with the usual seed piece and fair-sized single-eye sets. His conclusions were that the larger the size of the set planted the larger will be the resultant crop. In 1891 (*33*, p. 378) he published a second report, in which a comparison is made between whole, halved, and quartered tubers. The data in this case also were in favor of whole seed. These results were obtained, however, from plants spaced 44 by 18 inches apart, which spacing, of course, was distinctly the best for whole seed, as the larger the size of the set the greater should be the distance allowed between the plants.

Plumb (*70*) made a careful comparison of the relative merits of (1) whole tubers ranging in weight from 1 to 2 ounces up to 12 to 14 ounces; (2) large and medium-sized whole tubers, halves, quarters, and single eyes; and (3) whole tubers with halved sets from whole

tubers of the same weight. In the first set of experiments the largest yield was obtained from whole tubers weighing from 10 to 12 ounces, with the 8 to 10 ounce tubers second. The others came in the following order: 6 to 8, 4 to 6, 3 to 4 and 12 to 14 tied, 2 to 3, and 1 to 2. The net value of the crop, deducting the cost of seed used, gives an entirely different aspect to the experiment. The 1 to 2 ounce whole seed showed a net value of $42.95 per acre; the 2 to 3 ounce, $42.90; the 3 to 4 ounce, $38.90; and the 4 to 6 ounce, $35.45. The 8 to 10 ounce seed came next with $28.50, closely followed by the 6 to 8 ounce with $28.20, while the 10 to 12 ounce seed gave the largest yield but showed a profit of only $17.25 per acre. The 12 to 14 ounce seed gave the least profit, $10.40 per acre.

Brunk's conclusions (*19*) from a study of the relative merits of 10-ounce whole tubers, egg-size whole tubers, 2 to 4 eye sets from medium-sized tubers, and 1-eye sets for seed purposes are summarized in the following five sentences:

(1) The greater the quantity of the seed planted the greater the crop in total product.
(2) Generally, the more seed the more good potatoes of merchantable size.
(3) The most profitable seed potatoes on the average are those of egg size.
(4) The less quantity of seed used and the more it is cut, the less the probability of getting a full stand.
(5) Cutting potatoes to a single eye increases the missing hills so much as to materially reduce the crop.

It is believed that Brunk's second conclusion may well be challenged, as it is invariably true under normal conditions of growth that as the size of the set increases above the average or normal-sized set the percentage of merchantable-sized tubers decreases.

Taft (*95*, p. 18) found that halved tubers gave a larger yield of merchantable tubers than whole tubers, and the net increase was also greater. In one set of data whole tubers gave a net increase over seed used of 251.3 bushels per acre, while tubers of the same size halved gave a net increase of 296.7 bushels; quartered tubers, 244.1 bushels; eighths, 215.3 bushels; and single eyes, 173.9 bushels. In another experiment where whole and halved tubers of different sizes were compared Taft obtained the results shown in Table 2.

TABLE 2.—*Comparative test of whole and halved potato tubers and single-eye sets reported by Taft in 1890.*

Kind of seed.	Average weight (ounces).	Yield (bushels).		
		Merchantable.	Small.	Net increase.
Whole tubers	4⅘	370	62½	372½
Do	3½	361	31¾	348¾
Halved tubers	1¾	433	31	442
Whole tubers	1¾	349	45	372
Halved tubers	⅞	305½	44	338
Single eyes, cut deep	----------	173½	21½	----------

These data show that the largest yield was obtained from a 3½-ounce tuber halved. It is also shown that the net increase from whole tubers weighing 4⅘ ounces was practically identical with that from 1¾-ounce whole tubers. No explanation is given in regard to the poor showing made by the single-eye sets.

Stubbs (*93*) found that there was practically no difference in net yield between sets of two or more eyes and large whole tubers and but a slight difference between large and medium-sized whole tubers. One-eye sets gave a much lower yield. The net yields (bushels) were as follows: One-eye sets, 181; sets having two or more eyes, 225; medium-sized tubers, 220.5; large whole tubers, 225.5.

The data reported by Stubbs are in direct contrast to those presented by Troop (*99*), in which he found that whole tubers gave a net increase of 215 bushels per acre more than 1-eye sets and 130 bushels more than 2-eye sets.

Results reported by Speth (*89*) showed that small whole tubers gave a slightly larger yield than medium tubers halved. One-eye and two-eye sets produced a lower yield.

The conclusions of Green (*44*) were that ordinarily where the conditions were equal "the larger the set the greater the total product. In ordinary practice it is usually found that neither extreme as to quantity of seed will be found profitable. The safest plan is to use large well-matured healthy potatoes and cut to two or three eyes."

In 1891 and 1892 the following reports were made by station workers regarding the relative merits of large and small and whole and cut seed.

Beckwith (*13*) planted large, medium, and small tubers whole, halved, and 2-eye sets, the latter with one and two sets to the hill. The rows were 3½ feet apart and the sets spaced 12 inches apart in the row. The results indicated that 2-eye sets from large tubers gave the largest yield of merchantable tubers and with one exception the smallest proportion of unmerchantable stock. Medium-sized tubers planted whole and those cut in two gave the next largest yield of merchantable tubers. The largest total yield was from small tubers cut to two eyes with two sets to the hill, but nearly 50 per cent of the crop was unmerchantable.

Caldwell (*22*, p. 71) found that halved tubers gave the best results. The data obtained are shown in Table 3.

TABLE 3.—*Comparative test of cut potato seed reported by Caldwell in 1892.*

Kind of seed.	Yield (bushels).	
	Merchantable.	Total.
One and two eye pieces	140.1	193.1
Halves	183.7	271.7
Seed end removed	156.8	219.8

Hayward (*47*, p. 371) in two out of four trials obtained a larger net yield of merchantable tubers from small whole tubers than from large whole potatoes, commercial-sized sets, or 1-eye sets. Normal or commercial-sized seed was second best in two instances, first in another, and fourth in another.

Kinney (*57*, p. 113) compared 1-eye sets, 2-eye sets, and medium-sized whole tubers, but spaced them according to their size 9 inches, 18 inches, and 36 inches apart in the row. The results as presented in Table 4 were in favor of 2-eye sets.

TABLE 4.—*Comparative test of cut and whole potato seed, variously spaced in the row, reported by Kinney in 1891.*

Kind of seed.	Yield (bushels).		
	Merchantable.	Small.	Total.
One-eye sets	248.2	56.3	304.5
Two-eye sets	279.2	57.5	336.7
Medium size, whole	268.8	58.0	326.8

From his study of the relative desirability for seed purposes of large and medium sized whole potatoes, sets with two or more eyes, and 1-eye sets, Lee (*59*, p. 477) concluded that the larger the size of the seed planted the larger the yield. He qualified this statement, however, by saying that the economic results are in favor of cut seed containing not more than four nor less than two eyes to the set.

McDowell and Wilson (*62*, p. 3–4) secured slightly larger yields from whole tubers than from 2-eye sets, but they do not furnish the necessary data from which to compute the net yield.

Morgan and Burnette (*65*, p. 707), in their comparative study of 1-eye, 2-eye, 3-eye, 4-eye, and whole-tuber sets, concluded that when seed potatoes were cheap at planting time whole tubers might be used with profit, but, if not, sets containing from two to three eyes should be used.

The experiments of Newman and Clayton (*66*, p. 6–7) with whole and cut seed gave results decidedly in favor of whole tubers.

Richman (*74*) obtained a larger yield of merchantable tubers from small whole tubers than from large ones, quartered tubers, or 2-eye sets. Net yields are not given.

In a subsequent report Richman (*75*) presents data which indicate plainly that under the conditions in which he grew the crop the larger the set used the larger was the resultant crop. He planted 1-eye, 2-eye, quarter, half, and whole tubers. The net yields from the various sized seed in the order named were 109, 368, 387, 460, and 491 pounds, respectively. The sets were spaced 36 by 12 inches apart.

In 1893 Richman (*76*, p. 3–6) summarized the results for three seasons as follows: "The advantage gained by planting larger sets is not so great as at first seems apparent, owing to the fact that the larger sets take so much more seed . . . It is rather doubtful whether it will pay to plant sets larger than fourths."

Troop's data (*100*, p. 74–75) show a progressively larger yield as the size of the set increased. In 1889 the yield from 1-eye sets was at the rate of 132 bushels per acre; 2-eye sets, 235 bushels; 3-eye sets, 330 bushels; 4-eye sets, 336 bushels; 5-eye sets, 425 bushels; and whole tubers, 489 bushels.

From data obtained by planting whole tubers weighing from 1 to 8 ounces and halved tubers ranging in weight from half an ounce to 4 ounces Taft (*96*, p. 27) concluded that halved tubers are better than whole tubers of the same weight and therefore that a whole small potato is not as good for seed purposes as the half of a potato of twice its weight; that is, a 1-ounce whole tuber is not as good as half

of a 2-ounce tuber. Taft comments that the total yield gradually decreases with the size of the set. In the 1892 bulletin Taft (*97*, p. 14, 17) presents a two-year average of the yields obtained from whole and halved sets of equal weight. These data are of interest in that they show a larger average net yield from the half-ounce sets than from the larger sizes. The average yield from the three sets of seed of compared size shows an average net yield of 80.8 bushels per acre from the whole seed as against 79.2 bushels from halved seed. The difference between whole and cut seed is in this case (Table 5) too small to justify any conclusions regarding the merits of whole or cut seed.

TABLE 5.—*Comparative tests of whole and halved potato tubers of given weights, 2-year average, 1890 and 1891.*

Kind of seed.	Average yield for two years (bushels).	
	Marketable tubers.	Net yield.
Halves weighing 4 ounces	107.4	52.4
Wholes weighing 4 ounces	125.9	70.9
Halves weighing 2 ounces	115.5	88.0
Wholes weighing 2 ounces	102.3	74.8
Halves weighing 1 ounce	111.0	97.2
Wholes weighing 1 ounce	110.4	96.6
Halves weighing one-half ounce	107.2	100.2

A careful study by Arthur (*11*, p. 115) of sets ranging from 1 to 5 ounces in weight indicated that the 4, 4½, and 5-ounce sets gave larger yields than those of lesser weight. The Burbank and Beauty of Hebron varieties were studied.

Johnson (*51*) compared whole tubers with halves, quarters, and 1-eye pieces by planting an equal weight of seed on the same area of land. This was done by spacing the whole seed 36 inches apart in the row, the halved seed at 18 inches, the quartered seed at 9 inches, and the 1-eye sets (three of them together) at 9-inch intervals. In the case of the Early Rose and the White Star, the 1-eye sets gave the heaviest yield, while those of the Beauty of Hebron yielded least. Johnson explains the inferior yield from the 1-eye sets as being due to inequalities in the field in which the work was conducted.

Shaw and Zavitz (*86*) found that medium whole seed gave better results than large whole or cut seed.

In 1892 Speth (*90*) reported some studies made at the Georgia Experiment Station in which he secured the best results from large whole tubers from which all but two eyes had been removed prior to planting.

Blair (*16*) obtained slightly better results from halved tubers than from whole ones. A careful study of the behavior of slips and of 1-eye, 2-eye, 1-ounce, 2-ounce, and 4-ounce sets by Duggar (*28*) led him to the conclusion that 2-ounce sets were best, but he was of the opinion that in good soil an increased weight of seed might be advantageously used. Du Pre's (*30*) conclusions after studying the behavior of 1-eye and 2-eye sets, whole tubers, seed ends, stem ends, and middles were that sets cut to one and two eyes were better than whole potatoes and that the bud end will produce more than the

stem ends and middles. Harwood (*45*) obtained better results from 2-eye sets of the Rural New Yorker No. 2 variety than from 1-eye, half, or whole seed, but in the case of the Pearl of Savoy the whole tubers gave the largest yield. The conclusions of Harwood and Holden (*46*, p. 5–6) were that for ordinary planting distances halved potatoes gave better results than those of smaller size; that increased quantities of seed within ordinary limits give an increased yield, and that the increase of whole over halved tubers was not sufficient to cover the cost of the larger quantity of seed. In Buffum's experiments (*20*) tubers quartered lengthwise have the largest yield, followed by sets halved lengthwise and then cut crosswise. The third best yield was from small whole tubers. The conclusions of Miller and Brinkley (*63*, p. 79–81) were that the use of small potatoes for seed purposes returned the greatest net profit per acre and that large potatoes cut to egg size were the next most profitable. Large whole potatoes showed a loss of $9.64 per acre. Starnes (*91*) got the best yield from three-fourths-ounce sets spaced 8 inches apart in the row. The next best results were from the same weight of seed spaced 10 inches apart, and the third best from three-fourths-ounce seed spaced 6 inches apart in the row.

In 1896 Duggar (*29*) published a summary of experimental results obtained in 19 comparisons of single-eye and 2-eye sets; 4 comparisons of 2-eye sets and quarters; 17 comparisons of quarters and halves; and 44 comparisons of halves and whole potatoes. The average results from these several tests are summarized by Duggar under three heads: (1) Relative total yield, (2) relative gross salable yield, and (3) relative net salable yield. To facilitate comparison these data are assembled in Table 6, in which is presented the excess in yield of one size of set over the other.

TABLE 6.—*Comparative tests of whole and cut potato seed reported by Duggar in 1896.*

Excess from use of—	Total yield.		Gross salable yield.		Net yield.	
	Bushels.	Per cent.	Bushels.	Per cent.	Bushels.	Per cent.
2-eye over 1-eye sets	26	21	23	21	15	14
Quarters over 2-eye sets	15	16	10	15	7	15
Halves over quarters	24	18	15	15	5	6
Whole tubers over halves	31	18	14	10		
Halves over whole tubers					8.5	8

From a commercial standpoint the most interesting feature of the data shown in Table 6 is that pertaining to net yield, in which the superiority of halves over whole tubers is clearly demonstrated.

Duggar's conclusions (*29*) were that with seed and crop at the same price per bushel it was more profitable in these tests to plant halves than smaller cuttings and whole potatoes. . . . On the other hand, the higher price of potatoes in spring than in fall is an argument in favor of planting quarters rather than halves or whole tubers.

Foster's data (*37*, p. 17) show a decided increase in yield from average and medium-sized whole tubers over halves and 2-eye and 1-eye sets.

Schweitzer (*82*) found that there was a progressively larger yield as the size of the set increased. The yield from 1-eye sets was at the rate of 89.9 bushels per acre; 2-eye sets, 121.2 bushels; quarters, 146 bushels; halves, 154.1 bushels; and whole tubers, 186.3 bushels. No statement is made concerning the quantity of seed used, nor are figures given showing the net yield. In later studies by Buffum (*21*, p. 19–22) whole seed gave larger yields than cut seed, but this writer states that in no case was there such a large percentage of unsalable tubers from the cut seed as from the small whole potatoes.

Price and Ness (*72*, p. 112) compared one-fourth-ounce sets cut from 2-ounce and 4-ounce tubers with one-half-ounce sets cut from 2-ounce tubers and 2½-ounce tubers planted whole. The data given show a distinct gain of the one-half-ounce sets over the one-fourth-ounce piece from the same-sized tuber. The one-fourth-ounce sets from the 4-ounce tubers gave a larger yield than those from the 2-ounce tuber. As might have been expected, a larger total yield was obtained from the 2½-ounce whole tubers than from the cut seed, but it is questionable whether the actual net yield was greater.

In summarizing the averages of many experiments Rane (*73*, p. 72) says that "it was found that for every 100 bushels of net salable crop grown from single eyes there were 114 bushels from two eyes, 131 bushels from quarters, 139 bushels from halves, and 129 bushels from whole tubers."

Clausen (*25*) obtained increased yields from large tubers. He believes that large seed tubers insure better results in a dry season. He also considers them especially desirable in light soils. In the Duke of Bedford and Pickering's (*14*) comparative studies of the value of large, medium, and small whole tubers, the largest yield was secured from the medium-sized tubers, the increase being 24 per cent greater than from small seed and 34 per cent heavier than from the large seed.

Mookerji (*64*) found that when the same weights of cut seed and of whole seed were planted on a given area the cut seed gave the larger yield.

In a comparison of whole tubers with single eyes and cuttings, Pendlebury and Foulkes (*68*) obtained a slightly larger yield of table stock from the cuttings than from whole tubers, but the total yield was over a ton less per acre. The single-eye sets gave the lightest yield.

Emerson (*31*, p. 6–10) found that quartered tubers planted 12 inches apart at the rate of 18 bushels to the acre gave the best value per acre less the cost of seed. Half tubers planted 36 inches apart gave the next best results, while quarter tubers planted 9 inches apart gave the poorest yield.

A comparison of 8-ounce and 1-ounce whole tubers for seed purposes made by Waldron (*101*) resulted in a yield at the rate of 163.4 bushels of merchantable potatoes per acre from the 8-ounce tubers as against 66 bushels from the 1-ounce seed. Deducting the cost of seed, it was figured that the crop from the former was worth $58.41 per acre, as against $32.73 from the 1-ounce tubers.

A trial of whole and cut seed by Smith (*88*) for four years showed an average increase of 112 per cent in favor of the whole seed.

Bruce (*18*, p. 10–11) in summarizing his experiments comparing whole and cut seed concluded that when the same weight of seed is planted on a given area cut seed will give a larger yield of merchantable stock, but that it does not give a greater total crop than is obtained with whole seed.

Close and White (*26*, p. 161) found that larger yields were obtained from egg-sized tubers of both the Irish Cobbler and Green Mountain varieties than from walnut-sized tubers. Marble-sized tubers gave the smallest crop.

In a six-years' study of the comparative yields from large, medium, and small sized whole tubers by Zavitz (*104*, p. 102), the average production per acre from the three sizes was 338, 274, and 201 bushels, respectively. In 1916 the same author (*105*, p. 43) reported further experimental data in which a comparison had been made between single-eye sets varying from one-sixteenth of an ounce to 2 ounces in weight. The figures he gives show a progressive increase in yield from 46.2 to 132.7 bushels per acre in favor of the heavier set. Progressive increases were also obtained from sets of the same weight but with eyes ranging from two to five to the set. Whole potatoes were also found to be superior to two halves or four quarters planted in the same hill. Sheppard and Churchill (*87*) at the Edgeley, Dickinson, and Williston substations studied the value for seed purposes of large and small whole tubers and of 2-eye sets. They obtained for a 2-year period an average yield of 138.7 bushels of marketable tubers per acre from the large tubers, 92 bushels from the small whole tubers, and 101 bushels from the 2-eye sets.

Henshaw (*48*) demonstrated that medium-sized tubers, $1\frac{1}{2}$ to $1\frac{3}{4}$ inches in diameter, were best. With tubers of this size it would require from 15 to 18 hundredweight to plant an acre if they were spaced 28 by 14 inches apart. In two of the four seasons in which the tests were made cut seed gave the best results. In the other two seasons whole seed proved superior to cut seed. In experiments conducted by Bliss (*17*, p. 23) in three counties in Iowa in 1909, large whole tubers proved superior to halves, quarters, 2-eye sets, and 1-eye sets. The average yield of merchantable stock from the whole tubers was at the rate of 125.7 bushels per acre; halves, 100.1 bushels; and quarters, 93.2 bushels; while 2-eye and 1-eye sets yielded 85.8 bushels. Somewhat similar results are reported by Schollander (*81*, p. 28) in a summary of the results of a 5-year test of large and small whole tubers, large halves, and of 3-eye, 2-eye, and 1-eye pieces. The 5-year averages show that the yield of merchantable tubers was greatest from the large 1-eye sets. Large whole tubers gave the greatest total yield. The order of yields of merchantable tubers was (1) large 1-eye sets, (2) large whole tubers, (3) large 3-eye sets, (4) large 2-eye sets, and (5) small whole tubers. In total yield the order was (1) large whole tubers, (2) 1-eye sets, (3) small whole tubers, (4) 3-eye sets, and (5) 2-eye sets. Hume (*49*) compared sets averaging 1.4 ounces in weight with those weighing 0.8 ounce and obtained an increased yield of 27.6 per cent in favor of the larger sized set. The total yield per acre from the larger sets was at the rate of 180.6 bushels, while that from the small sets was 141.5 bushels.

The data presented by Ferris (*36*, p. 20) show a progressive increase in yield as the size of the set increases, but the net yield from the whole tubers was not as great as that produced by a set three-fourths the size of the whole tuber. Georgeson's (*38*) results convinced him that small whole tubers gave better yields than sets of any other size. In Federov's experiments (*34*) better results were obtained from large whole tubers than from medium and small tubers or from cut sets. In a later publication (*35*) he modified his 1914 statement by favoring medium as well as large sized whole potatoes or the use of small potatoes planted two in the hill. Kotelnikov (*58*) found that while larger yields were produced from large whole tubers, the net profit was not so great as when smaller tubers averaging 2 ounces each were planted. It was also observed that the vegetative energy of smaller tubers was 7 to 11 per cent greater than that of larger ones.

According to Igonin (*50*) the increase in yield is not in proportion to the size of the seed tuber, as he found that the net crop from small tubers was greater than from large ones. The largest crop was obtained from the use of medium-sized seed. In experiments carried out by the Agricultural Department of New South Wales, Pinn (*69*, p. 15) says that in the comparison of the relative merits of whole and cut seed the results were no more favorable to the one than to the other.

In a comparative test of cuttings, seedt ubers, and peelings Lind (*60*) claims that the results from cuttings were practically as good as from seed tubers. Peelings did not give as good results, but are thought worthy of trial when seed tubers are scarce.

Aicher (*3*, *4*) summarizes the results of several years' experiments as follows: "The total yield from whole tubers was 15.4 per cent more than from cut tubers. Cut tubers yielded 18 per cent more marketable potatoes per acre than whole tubers. The percentage of marketable tubers increased as the size of the set decreased. The larger the set the greater was the number of the tubers produced and the smaller the average weight per tuber.

Very similar statements are to be found in Welch's report (*102*) from which the following is quoted:

> In every size planted whole tubers produced smaller potatoes than halved, and halved produced smaller potatoes than quartered.
>
> The greatest yield of marketable potatoes was produced from 8 to 10 ounce tubers halved.
>
> Under conditions which prevail on the average irrigated farm in southern Idaho the planting of whole potatoes is not advisable.

In an unsigned article published in the Orange Judd Farmer (*1*) for May 11, 1918, the results obtained by a comparative study of the relative merits of parings, eyes, and cut seed are presented. These data record a yield of 31 bushels per acre from parings, 74 bushels from the eyes, and 157 bushels from the cut seed.

Appleman's experiments (*9*, p. 90–96) led him to conclude that the tuber yield increases directly with the weight of the set planted. Appleman states, however, that while this conclusion is clear it is by no means profitable to increase the quantity of seed up to the maximum yield per acre. The cost of the seed and the distance between rows and sets in the row are to a large degree the limiting factors.

In 1919 Selvig (*85*, p. 56–59) reported the results of size-of-seed studies made at the Minnesota Northwest Experiment Station, Crookstown, Minn., in which single-eye, 2-eye, and quarter-tuber sets each weighing an ounce, halved tubers 2 ounces in weight, and whole tubers weighing 2, 3, 4.1, and 9.5 ounces, respectively, were carefully studied with respect to the number of stems and tubers produced. The conclusions were that yields do not increase in direct proportion to the size of the set. Increased yields from the planting of halves and whole seed of the different sizes have not been sufficient to offset the increased cost arising from the extra seed needed and the necessity of hand planting. The number of stems increased slightly but gradually in sets of the same weight with increase in number of eyes on the set.

In 1922 Rosa (*78*) reported the results of a four-year study of size of seed piece. The Early Ohio variety was used in this experiment, and four sizes of seed were studied in both the whole-tuber and cut-seed class. The tests were with seed pieces 20, 30, 40, and 50 grams in weight. Rosa's conclusions were that the most profitable size of seed piece to use in his section did not lie much beyond an ounce in weight.

Salaman's conclusions (*79*) from a two-year study of the influence of size and character of seed on the yield of potatoes were as follows:

> The total yield varies directly with the weight of the tuber set. Small sets under 1 ounce in weight, although giving a greater return in proportion to their weight and a high proportion of heavy ware (large merchantable tubers) are uneconomical. Taking into consideration the total weight of seed used, the proportion of heavy ware produced, and the total yield, sets of 2 ounces in weight are the most remunerative. There is an inverse ratio between the size of the seed set and the percentage of heavy ware in the resultant crop.

Studies of the results from whole small tubers and pieces of large tubers from the same plant by Stewart (*92*, p. 27) are summarized as follows:

> For seed purposes uncut tubers between 1 and 2 ounces in weight are at least as good as and probably a little better than pieces of equal weight cut from large tubers of the same plant . . . The yield of the potato plant increases as the number of stalks increases.
>
> The use of uncut tubers for seed does not always result in a large number of stalks or in a large proportion of small tubers in the crop.

DEPARTMENTAL STUDIES OF THE SIZE OF THE SET.

Experimental studies to determine the relative value of whole and cut seed and medium and small-sized tubers were undertaken by the Office of Horticultural and Pomological Investigations in 1913, but no carefully conducted tests were made until 1914. In that year studies were made at the Virginia Truck Experiment Station, Norfolk, Va., and at Caribou, Me. In the following year the work in Maine was transferred to Aroostook Farm, Presque Isle, Me., and similar studies were undertaken at the potato experiment stations at Greeley, Colo., and Jerome, Idaho. The varieties experimented with at the four points mentioned consisted of the Irish Cobbler at Norfolk, Va., the Irish Cobbler and Green Mountain at Caribou and Presque Isle, Me., the Rural New Yorker No. 2 at Greeley, Colo., and the Charles Downing (Idaho Rural) and Russet Burbank (Netted Gem) at Jerome, Idaho.

In the conduct of these studies considerable care was exercised to select tubers of uniform size, regardless of whether they were to

be planted whole or cut into halves or quarters. Therefore, in order to insure the greatest degree of uniformity all tubers used in this experiment were carefully weighed. For example, in separating the different lots of tubers only those were taken that came within 5 grams of the desired weight of 1, 2, 3, 4, 5, and 6 ounces, respectively; that is, the maximum variation between the tubers in any given lot did not exceed 10 grams.

Three sets of observations were made in most of the tests. The first was the relation of the size of the set to the weight of the crop obtained. The second factor studied was the correlation of the size of the set and the number of tubers produced, while the third was the correlation between the size of the set planted and the number of stems produced. The last observation also permits a fourth comparison relating to the correlation between the average number of stems and the average set of tubers to the stem. In the Virginia and Maine experiments the tubers from each set or hill were separated into primes and culls on the basis of weight. All tubers weighing 85 grams or over were regarded as primes or merchantable stock, while all below this weight were classed as culls, and counts were made of the number of each class of tubers and the weight of each lot recorded. At Greeley and Jerome the tubers were separated on the same basis, but a record was not kept of the performance of each individual set.

Closer spacing of the sets in the row was practiced in the earlier experiments than after 1915. This was particularly true in the Virginia and Maine tests. At the Virginia Truck Experiment Station the sets were spaced 15 inches in the row in 1914 and 14 inches in 1915. In Maine 12-inch spacing of the sets was practiced in both 1914 and 1915. In 1916 and thereafter the spacing at all points where the work was conducted (except at Greeley in 1915 [3]) was at a distance of 16 inches. At the Greeley and Jerome stations the crop was grown under irrigation.

In making the count of stems it was found that prior to harvesting the plants field counts were not so reliable as those made at the time of digging. This unreliability was due to the fact that in many instances what appeared to be two distinct stems turned out upon closer examination to be only a single stem, the branching having occurred well beneath the surface of the soil. Such branching was almost invariably found to be the result of injury to the primary shoot before its emergence from the ground. This injury was in most cases due to an attack of Rhizoctonia or to a mechanical injury from cultivator or harrow teeth in tillage before the plants appeared. The quickest and most satisfactory method of making the count of stems at harvest time, especially when the stems had dried down, was to have a workman partially lift the hill with a digging fork, leaving the stems in position in the soil but in such condition as to be easily removed and recorded. By having each hill in the row numbered those conducting the work were able to study the relation between the number of stems and tubers to the size of sets.

In studying the data it is at once apparent that seasonal variations as regards temperature and rainfall produce marked variations in yield and adversely affect the behavior of whole or cut seed. When there is an abundance of available moisture and plant food the sets

[3] In 1918 the planting was done with a two-man planter with the result that the spacing was somewhat closer. With rows spaced 3 feet apart and the sets 16 inches apart in rows, it requires 11.35 bushels of seed to plant an acre with 1-ounce sets. The 1918 planting at Greeley required 13 bushels.

of larger size, especially the whole tubers, will produce a heavier yield than those of smaller size. With these conditions reversed the advantage is in favor of the medium to smaller set, because it does not produce as many stems and in consequence does not set as many tubers; therefore a larger percentage of them reach marketable size.

EXPERIMENTS AT THE VIRGINIA TRUCK EXPERIMENT STATION.

The trials at the Virginia Truck Experiment Station in 1914 included 2-ounce whole and halved, 3-ounce whole and halved, and 4 and 6 ounce whole and halved tubers. In the following year the test was enlarged to include 4-ounce halved and quartered, and 6-ounce quartered during 1916, 1917, and 1918. The study included in addition to the sizes mentioned, 3-ounce quartered and 5-ounce whole, halved, and quartered, thus giving a range of three-fourths of an ounce to 6 ounces in size of set planted. In the 1919 studies only two sizes were used, 3 and 4 ounce tubers. A part of these were planted whole; others were halved and still others quartered.

In tabulating the yield obtained from these sets of various sizes during the six seasons mentioned, it has been thought desirable to group those of the same character, regardless of their weight. For example, the whole tubers are presented first and then the halved and quartered sets in the order named. A careful study of the data presented in Table 7 shows low yields in 1914, 1917, and 1919, medium or normal yields in 1915 and 1918, and a high yield in 1916. In view of the fact that these six crops were grown in alternate years on adjacent plats of land, it seems justifiable to assume that the seasonal variations in yield were due to fluctuation in climatic rather than in soil-fertility conditions. In the "Yield of primes, net" columns the weight of seed planted was deducted from the 2-ounce whole or halved seed, notwithstanding the fact that a 2-ounce tuber is not generally regarded as merchantable. This course was pursued in order to make the comparison as nearly uniform as possible.

TABLE 7.—*Comparative yields from Irish Cobbler potato sets of different sizes at the Virginia Truck Experiment Station in stated years.*

[In the columns headed "Yield of primes, net" the quantity of seed planted has been deducted, making the number of bushels net, as given.]

Kind of set planted.	Weight of set.	Yields per acre, 1914.				Yields per acre, 1915.				Yields per acre, 1916.			
		Primes	Culls.	Yield of primes.		Primes	Culls.	Yield of primes.		Primes	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.			Actual.	Net.
				Per cent.				*Per cent.*				*Per cent.*	
Whole:	*Ozs.*	*Bush.*	*Bush.*		*Bush.*	*Bush.*	*Bush.*		*Bush.*	*Bush.*	*Bush.*		*Bush.*
2-ounce	2	87.2	75.8	53.5	67.0	221.7	57.1	79.5	198.2	300.1	96.2	75.7	279.3
3-ounce	3	67.9	85.0	44.4	34.9	264.2	68.3	79.5	228.9	366.7	100.7	78.5	335.4
4-ounce	4	87.1	107.1	44.9	43.1	259.2	79.2	76.6	212.1	367.8	120.2	75.4	321.6
5-ounce	5									391.0	148.8	72.4	338.2
6-ounce	6	121.2	87.5	58.1	55.2	220.4	108.8	67.0	149.8	388.0	168.2	69.8	325.5
Halved:													
2-ounce	1	82.9	52.3	61.3	71.9	220.0	36.7	85.7	208.2	216.7	57.7	79.0	195.9
3-ounce	1½	89.2	61.9	59.0	72.7	230.8	40.0	85.2	213.1	374.0	66.0	85.0	358.4
4-ounce	2	118.5	72.7	62.0	96.5	276.7	47.5	85.3	253.2	356.2	72.8	83.0	335.4
5-ounce	2½									389.2	77.6	83.4	362.8
6-ounce	3	123.1	73.8	62.5	90.1	270.8	57.1	82.6	235.5	383.4	82.1	82.4	352.2
Quartered:													
3-ounce	¾									357.4	48.6	88.0	349.6
4-ounce	1					232.9	37.5	86.1	221.1	346.3	68.1	83.5	330.9
5-ounce	1¼									347.1	57.7	85.7	333.9
6-ounce	1½					245.8	43.3	85.0	228.1	342.5	62.5	84.6	326.9

TABLE 7.—*Comparative yields from Irish Cobbler potato sets of different sizes at the Virginia Truck Experiment Station in stated years*—Continued.

Kind of set planted.	Weight of set.	Yields per acre, 1917.				Yields per acre, 1918.				Yields per acre, 1919.			
		Primes	Culls.	Yield of primes.		Primes	Culls.	Yield of primes.		Primes	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.			Actual.	Net.
Whole:	*Ozs.*	*Bush.*	*Bush.*	*Per cent.*	*Bush.*	*Bush.*	*Bush.*	*Per cent.*	*Bush.*	*Bush.*	*Bush.*	*Per cent.*	*Bush.*
2-ounce	2	163.7	67.0	71.0	142.9	196.8	57.0	77.5	174.6				
3-ounce	3	163.1	83.1	66.2	131.8	219.3	74.0	74.8	188.1	148.6	102.0	59.3	117.4
4-ounce	4	185.7	91.1	67.1	144.0	228.3	82.6	73.4	186.6	153.2	114.1	57.3	111.5
5-ounce	5	177.5	94.2	65.3	125.4	244.4	78.9	75.6	192.3				
6-ounce	6	192.2	113.5	62.9	129.7	214.8	86.7	71.2	152.3				
Halved:													
2-ounce	1	134.0	49.1	73.2	123.8	200.7	42.2	82.6	190.3				
3-ounce	1½	151.2	52.6	74.2	135.6	220.6	49.2	81.8	205.0	165.4	55.0	75.0	149.8
4-ounce	2	167.3	56.8	74.7	146.5	232.4	50.9	82.0	211.6	166.7	64.9	72.0	145.9
5-ounce	2½	174.5	58.1	75.0	148.5	247.5	49.5	83.3	221.5				
6-ounce	3	163.4	64.9	71.6	132.1	205.4	58.4	77.9	174.2				
Quartered:													
3-ounce	¾	125.8	41.6	75.1	118.0	218.2	33.5	86.7	210.4	156.6	35.0	81.7	148.8
4-ounce	1	138.5	38.4	78.3	128.1	221.1	38.8	85.1	179.9	158.9	42.6	78.9	148.5
5-ounce	1¼	155.0	35.5	81.4	142.0	226.2	39.0	85.3	221.5				
6-ounce	1½	131.5	44.4	74.8	118.4	211.0	38.2	84.7	195.4				

AVERAGE YIELDS FOR THREE STATED PERIODS.

Kind of set planted.	Weight of set.	Average yields per acre, 1914 to 1918.				Average yields per acre, 1915 to 1918.				Average yields per acre, 1916 to 1918.			
		Primes	Culls.	Yield of primes.		Primes	Culls.	Yield of primes.		Primes	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.			Actual.	Net.
Whole:	*Ozs.*	*Bush.*	*Bush.*	*Per cent.*	*Bush.*	*Bush.*	*Bush.*	*Per cent.*	*Bush.*	*Bush.*	*Bush.*	*Per cent.*	*Bush.*
2-ounce	2	193.9	70.62	73.3	172.4	220.58	69.33	76.1	198.8	220.2	73.4	75.0	199.4
3-ounce	3	216.24	83.22	72.2	183.9	253.33	81.53	75.7	221.1	249.7	85.93	74.4	218.43
4-ounce	4	225.62	96.04	70.1	181.5	260.25	93.28	73.6	216.1	260.6	97.97	72.7	217.40
5-ounce	5									270.97	107.30	71.6	218.63
6-ounce	6	227.32	112.94	66.8	162.5	253.85	119.30	68.0	189.3	265.00	122.80	68.3	202.50
Halved:													
2-ounce	1	170.86	47.60	78.2	179.6	192.85	26.43	87.9	179.6	183.80	49.67	78.7	170.00
3-ounce	1½	213.16	53.94	79.8	196.9	244.15	51.95	82.5	228.0	248.60	55.93	81.6	233.00
4-ounce	2	230.22	60.14	79.3	208.6	258.15	57.00	81.9	236.7	251.97	60.17	80.7	231.17
5-ounce	2½									270.40	62.40	81.3	244.27
6-ounce	3	229.22	67.26	77.3	196.8	255.75	65.63	79.6	226.9	250.73	68.47	78.5	219.50
Quartered:													
3-ounce	¾									233.80	41.23	85.0	226.00
4-ounce	1					234.70	45.70	83.7	215.0	235.30	48.43	82.9	219.97
5-ounce	1¼									242.77	44.07	84.6	229.70
6-ounce	1½					232.70	47.10	83.2	217.2	228.23	48.37	82.5	213.57

As a rule, the data show a gradual decline in the percentage of prime potatoes as the size of the set, either whole or cut, increases. In 1914 the highest net yield of primes was obtained from 4-ounce tubers halved, while the next highest was from the 6-ounce halved sets. In 1915 the 4-ounce halved tubers again gave the highest net yield and were followed, as in 1914, by the 6-ounce halved tubers, the 3-ounce whole and 6-ounce quartered following in the order stated. In 1916 the 5-ounce halved tubers, used for the first time in this experiment, stood at the head of the list, closely followed by the

3-ounce halved-tuber lot. The 6-ounce halved and the 3-ounce quartered tubers came next. The 5-ounce whole tubers were fifth, while the 4-ounce halved and 3-ounce whole tubers tied for sixth place. In 1917 the 5-ounce halved tubers again gave the largest net yield. The 4-ounce halved seed was a close competitor, with 4-ounce whole, 2-ounce whole, and 5-ounce quartered tubers occupying third, fourth, and fifth positions, respectively. The differences in yield from the sizes mentioned are relatively slight and have no real significance. In 1918, 5-ounce halved and 5-ounce quartered tubers gave the largest net yields, followed by 4-ounce halved, 3-ounce quartered, and 3-ounce halved tubers. In the 1919 experiments 3-ounce halved, 3-ounce quartered, 4-ounce quartered, and 4-ounce halved tubers were very close competitors. It is apparent from these data that there is no consistent superiority of any size of seed tuber or set, except possibly in the case of 4-ounce and 5-ounce halved tuber sets. In the 1914 to 1918 average production columns, the 4-ounce halved tubers show

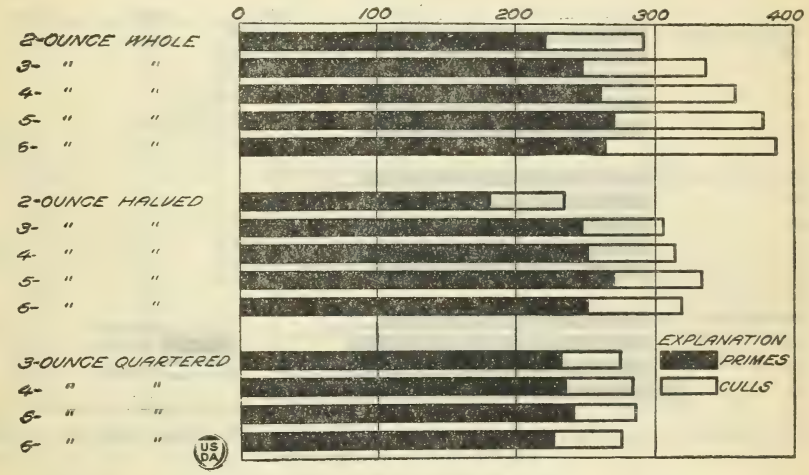

FIG. 1.—Average yields in bushels per acre from Irish Cobbler potato sets of different weights at the Virginia Truck Experiment Station, Norfolk, Va., in 1916, 1917, and 1918.

the highest net yield of primes, while the 3 and 6 ounce halved sets are close competitors for second place. The averages for the years 1915 to 1918 show that the 4-ounce halved tubers produced the largest net yield of merchantable stock. The 3-ounce halved tubers came next, and 6-ounce halved tubers came third. In the 1916 to 1918 averages 5-ounce whole, halved, and quartered sets appear for the first time. The 5-ounce halved seed gave the highest net yield of primes, followed in their order by the 3-ounce halved, the 4-ounce halved, and the 5-ounce quartered sets. (Fig. 1.)

STUDIES AT CARIBOU AND PRESQUE ISLE, ME.

SIZE OF IRISH COBBLER SEED.

The experimental studies of the size of set of the Irish Cobbler variety conducted at Caribou, Me., in 1914 and on the Aroostook Farm, Presque Isle, Me., in 1915 to 1918, the data from which are presented in Table 8, were designed to serve as a check on the Norfolk studies. In 1914 the 4-ounce halved tubers gave the highest net

yields. The 3-ounce halved and 3-ounce whole tubers came next. In 1915, with the average yield per acre more than double that of the previous season, the highest net yield was obtained from the 3-ounce whole tubers; the 2-ounce whole sets gave the second highest yield, and the 3-ounce halved sets came third. With greatly reduced yields in 1916 the 2-ounce halved sets gave the highest net yield, 4-ounce quartered second, and 3-ounce quartered third. In 1917, with yields quite similar to 1916, 4-ounce quartered sets gave the most net bushels of primes per acre, closely followed by 6-ounce quartered, 6-ounce halved, and 5-ounce halved sets. The following year, 1918, 5-ounce quartered sets gave the highest net yield of primes, 6-ounce quartered sets came second, and 4-ounce halved sets third. A further study of the data in Table 8, based on the average net yields for the four years from 1915 to 1918, inclusive, shows that 2-ounce halved seed gave the largest net yield of primes, closely followed by the 3-ounce halved tubers. The largest average yield of

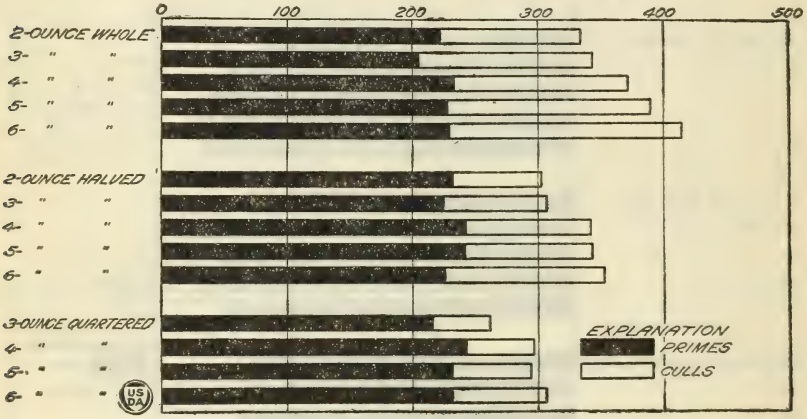

FIG. 2.—Average yields in bushels per acre from Irish Cobbler potato sets of different weights at Presque Isle, Me., in 1916, 1917, and 1918.

primes minus the seed used for the years 1916 to 1918 was obtained from the 4-ounce quartered seed. The 2-ounce halved came second, closely followed by the 5-ounce and 6-ounce quartered and the 4-ounce and 5-ounce halved. (See fig. 2 for total yields.) If, however, the average net yield of the 5-year period from 1914 to 1918 be taken for the 2-ounce whole and the 3-ounce and 4-ounce whole and halved sets, the 3-ounce halved sets show the highest net merchantable yield, closely followed by 4-ounce halved and 3-ounce whole sets. The 2-ounce whole seed was fourth and the 4-ounce whole seed last.

The foregoing explanation of the data and the relative value of the size of set used has been based entirely upon the net yield of merchantable tubers. This comparison has been made because it is believed that this is the most important commercial aspect of potato production. One should not lose sight, however, of another aspect of the subject, viz, the production of seed stock. For ex-

ample, the average total production per acre from 6-ounce whole tubers for the years 1915 to 1918 was 485.98 bushels, whereas that from the 2-ounce halved tubers which showed the highest net yield of primes was only 365.6 bushels. The former produced only 61.5 per cent of merchantable tubers, whereas the latter gave 81.1 per cent. The question might well be raised at this point whether the progeny of the 6-ounce whole tubers would not furnish the larger quantity of desirable seed stock. Under these circumstances the seed-potato grower should seriously consider the use of medium-sized whole tubers in the planting of his seed plat.

TABLE 8.—*Comparative yields from Irish Cobbler potato sets of different sizes at Presque Isle, Me., in stated years.*

[In the columns headed "Yield of primes, net" the quantity of seed planted has been deducted, making the number of bushels net, as given.]

Kind of set planted.	Weight of set.	Yields per acre, 1914.				Yields per acre, 1915.			
		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.
Whole:	*Ozs.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*
2-ounce	2	199.3	151.3	56.8	167.3	538.8	90.8	85.6	506.8
3-ounce	3	285.9	117.0	71.0	237.9	606.7	139.2	81.3	558.7
4-ounce	4	270.2	148.2	64.6	206.1	515.3	119.3	81.2	451.2
5-ounce	5								
6-ounce	6					508.0	191.8	72.6	411.9
Halved:									
2-ounce	1					491.4	62.8	88.7	475.4
3-ounce	1½	263.1	101.5	72.2	239.0	524.9	83.4	86.3	500.9
4-ounce	2	300.1	133.9	69.1	268.1	534.7	99.3	84.3	444.6
5-ounce	2½								
6-ounce	3					476.6	140.1	77.3	428.6
Quartered:									
3-ounce	¾					346.2	37.5	90.2	337.2
4-ounce	1					426.6	27.8	93.9	410.6
5-ounce	1¼								
6-ounce	1½					394.3	25.6	93.9	370.3

Kind of set planted.	Weight of set.	Yields per acre, 1916.				Yields per acre, 1917.				Yields per acre, 1918.			
		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.			Actual.	Net.
Whole:	*Ozs.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*
2-ounce	2	188.2	129.7	59.2	164.2	237.0	100.4	70.2	213.0	240.4	111.8	68.3	216.4
3-ounce	3	181.8	168.8	51.9	145.8	207.7	108.7	65.6	171.7	223.1	135.5	62.2	187.1
4-ounce	4	248.2	111.8	68.9	200.2	237.9	142.1	62.6	189.9	213.1	159.9	57.1	165.1
5-ounce	5	226.2	177.3	56.1	166.2	239.9	130.8	64.7	179.9	220.4	175.4	56.7	160.4
6-ounce	6	202.6	199.2	50.4	130.6	262.3	173.7	60.2	190.3	221.8	184.5	54.6	149.8
Halved:													
2-ounce	1	246.1	83.4	74.7	234.1	226.8	70.0	76.4	214.8	221.1	60.8	78.4	209.1
3-ounce	1½	201.6	105.8	65.6	183.6	235.7	69.9	77.1	217.7	236.8	72.7	76.5	218.8
4-ounce	2	216.9	127.4	63.0	192.9	257.1	83.1	75.6	223.1	246.8	91.8	72.9	222.8
5-ounce	2½	220.6	119.8	64.8	190.6	266.4	79.1	77.1	236.4	233.6	104.8	69.0	203.6
6-ounce	3	184.9	161.2	53.4	148.9	274.2	92.7	74.7	238.2	216.7	124.1	63.6	180.7
Quartered:													
3-ounce	¾	213.2	48.8	81.4	204.2	209.5	48.0	81.4	200.5	226.9	44.4	83.6	217.9
4-ounce	1	238.9	64.4	78.8	226.9	258.7	55.3	82.4	246.7	230.3	44.3	83.9	218.3
5-ounce	1¼	213.2	87.3	70.9	198.2	210.9	50.3	80.7	195.9	270.5	51.3	84.1	255.5
6-ounce	1½	193.0	101.6	65.5	175.0	256.7	59.1	81.3	238.7	243.8	63.8	79.3	225.8

TABLE 8.—*Comparative yields from Irish Cobbler potato sets of different sizes at Presque Isle, Me., in stated years*—Continued.

AVERAGE YIELDS FOR THREE STATED PERIODS.

Kind of set planted.	Weight of set.	Average yields per acre, 1914 to 1918.				Average yields per acre, 1915 to 1918.				Average yields per acre, 1916 to 1918.			
		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.			Actual.	Net.
Whole:	*Ozs.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*
2-ounce	2	280. 74	116. 80	70. 6	253. 54	301. 10	108. 80	73. 5	275. 10	221. 87	113. 97	66. 1	197. 87
3-ounce	3	301. 04	133. 84	69. 2	260. 24	304. 83	138. 05	68. 8	265. 83	204. 20	137. 67	59. 7	168. 20
4-ounce	4	296. 94	136. 26	68. 5	242. 50	303. 63	133. 28	69. 5	251. 60	233. 07	137. 63	62. 8	185. 07
5-ounce	5									228. 83	161. 17	58. 7	168. 83
6-ounce	6					298. 68	187. 30	61. 5	220. 65	228. 90	185. 80	55. 2	156. 90
Halved:													
2-ounce	1					296. 35	69. 25	81. 1	283. 35	231. 33	71. 40	76. 4	219. 33
3-ounce	1½	292. 42	86. 66	77. 1	272. 00	299. 75	82. 95	78. 3	280. 25	224. 76	82. 80	73. 1	206. 70
4-ounce	2	311. 12	107. 10	74. 4	270. 30	313. 88	100. 40	75. 8	270. 85	240. 27	100. 77	70. 5	212 93
5-ounce	2½									240. 20	101. 23	70. 4	210. 20
6-ounce	3					288. 10	129. 53	69. 0	249. 10	225. 27	126. 00	64. 1	189. 27
Quartered:													
3-ounce	¾					248. 95	44. 68	84. 8	239. 95	216. 53	47. 07	82. 1	207. 53
4-ounce	1					288. 63	47. 95	85. 8	275. 63	242. 63	54. 67	81. 6	230. 63
5-ounce	1¼									231. 53	62. 97	78. 6	216. 53
6-ounce	1½					271. 95	62. 53	81. 3	252. 45	231. 17	74. 83	75. 5	213. 17

SIZE OF GREEN MOUNTAIN SETS.

A similar study, though not so extensive, was made with the Green Mountain variety to determine whether different varieties gave similar responses from sets of the same sizes. Only four sizes were tested in 1914, viz, 2-ounce and 3-ounce whole and halved and 6-ounce whole. The largest net yield of primes (Table 9) was

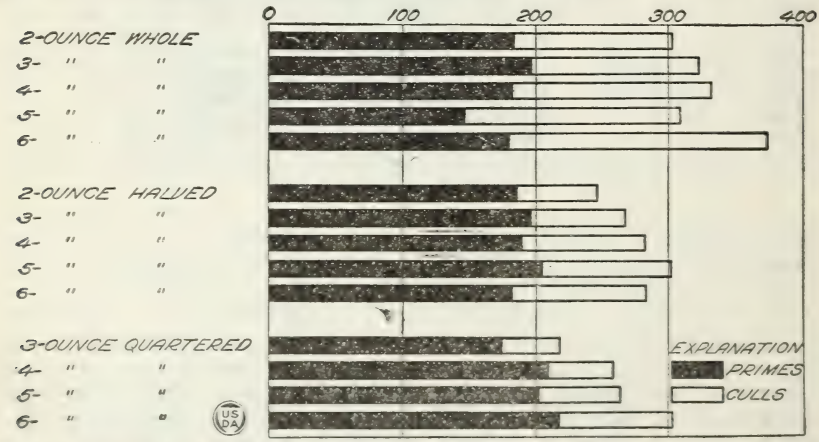

FIG. 3.—Average yields in bushels per acre from Green Mountain potato sets of different weights at Presque Isle, Me., in 1917 and 1918.

obtained from 3-ounce halved. The 2-ounce whole sets came second, 6-ounce whole third, and 3-ounce whole last. No further study was made with the Green Mountain variety until 1917, when sizes ranging from three-fourths of an ounce to 6 ounces were used. The 1917 experiment was repeated in 1918. The average net yield of primes for the two seasons showed that the 6-ounce quartered sets gave the largest yield. The 4-ounce quartered sets came second, 5-ounce quartered third, and 3-ounce halved fourth. (See fig. 3 for total yield.)

The data in Table 9 show, as in the case of the Irish Cobbler, that the largest total yield was produced by the 6-ounce whole tubers and that even after deducting the seed used the yield was considerably greater than its nearest competitor, the 4-ounce whole, which came second. The 3-ounce whole tubers came third.

TABLE 9.—*Comparative yields from Green Mountain potato sets of different sizes at Caribou and Presque Isle, Me., in stated years.*

[In the columns headed "Yield of primes, net" the quantity of seed planted has been deducted, making the number of bushels net, as given.]

Kind of set planted.	Weight of set.	Yields per acre, 1914.				Yields per acre, 1917.				Yields per acre, 1918.			
		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.			Actual.	Net.
Whole:	*Ozs.*	*Bush.*	*Bush.*	*P.ct.*	*Bush.*	*Bush.*	*Bush.*	*P.ct.*	*Bush.*	*Bush.*	*Bush.*	*P.ct.*	*Bush.*
2 ounce	2	279.8	223.7	55.6	247.8	200.3	104.8	65.6	176.3	164.9	137.8	54.5	140.9
3-ounce	3	202.3	125.9	61.6	154.3	198.0	122.6	61.8	162.0	195.8	128.9	60.3	159.8
4-ounce	4					206.2	126.8	61.9	158.2	155.2	175.8	46.9	107.2
5-ounce	5					163.9	126.2	56.5	103.9	130.7	196.0	40.0	70.7
6-ounce	6	314.1	322.3	49.4	218.1	261.9	151.4	63.4	189.8	96.6	237.1	28.9	24.5
Halved:													
2-ounce	1					192.1	62.7	75.4	180.1	179.4	55.9	76.2	167.4
3-ounce	1½	290.7	159.9	64.5	266.7	191.8	69.5	73.4	173.8	198.9	72.5	73.3	180.9
4-ounce	2					209.1	83.5	71.5	185.1	170.3	98.5	63.4	146.3
5-ounce	2½					220.2	87.0	71.7	190.2	189.0	108.0	63.6	159.0
6-ounce	3					201.1	72.0	73.6	165.1	160.0	131.8	54.8	124.0
Quartered:													
3-ounce	¾					148.3	50.0	74.8	139.3	200.5	40.3	83.3	191.5
4-ounce	1					204.5	54.6	78.9	192.5	214.7	42.6	83.4	202.7
5-ounce	1¼					204.2	56.2	78.4	189.2	199.9	64.3	75.7	184.9
6-ounce	1½					232.8	98.5	70.3	214.8	202.8	70.8	74.1	184.8

AVERAGE YIELDS FOR TWO STATED PERIODS.

Kind of set planted.	Weight of set.	Average yield per acre, 1914, 1917, and 1918.				Average yield per acre, 1917 and 1918.			
		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.
Whole:	*Ozs.*	*Bush.*	*Bush.*	*Per ct.*	*Bush.*	*Bush.*	*Bush.*	*Per ct.*	*Bush.*
2-ounce	2	215.0	155.43	58.0	188.33	182.6	121.3	60.1	158.6
3-ounce	3	198.7	125.80	61.2	158.70	196.9	125.8	61.0	160.9
4-ounce	4					180.7	151.3	54.5	132.7
5-ounce	5					147.3	161.1	47.8	87.3
6-ounce	6	224.20	236.93	48.2	144.20	179.3	194.3	48.0	107.2
Halved:									
2-ounce	1					185.8	59.3	75.8	173.7
3-ounce	1½	227.13	101.63	69.1	207.13	195.4	71.0	73.3	177.3
4-ounce	2					189.7	91.0	67.6	165.7
5-ounce	2½					204.6	97.5	67.7	174.6
6-ounce	3					180.6	101.9	63.9	144.5
Quartered:									
3-ounce	¾					174.4	45.2	79.4	165.4
4-ounce	1					209.6	48.6	81.2	197.6
5-ounce	1¼					202.0	60.2	77.0	187.0
6-ounce	1½					217.8	84.7	72.0	199.8

EXPERIMENTS AT THE COLORADO POTATO EXPERIMENT STATION.[4]

The size-of-seed studies at Greeley, Colo., were confined to the Rural New Yorker No. 2 variety. Tubers and cut seed of the following sizes were planted in 1916 and 1917: 1-ounce whole, 2-ounce whole and halved, and whole, halved, and quartered sets of tubers weighing 3, 4, 5, and 6 ounces. In 1918 only seven sizes of sets were used, viz, 1-ounce whole, 2-ounce whole and halved, 3-ounce whole, 4-ounce halved and quartered, and 6-ounce halved.

TABLE 10.—*Comparative yields from Rural New Yorker No. 2 potato seed of different sizes at Greeley, Colo., in stated years.*

[In the columns headed "Yield of primes, net" the quantity of seed planted has been deducted, making the number of bushels net, as given.]

Kind of set planted.	Weight of set.	Yield per acre, 1916.				Yield per acre, 1917.				Yield per acre, 1918.			
		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.			Actual.	Net.
Whole:	*Ozs.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*
1-ounce	1	234.0	22.9	91.1	222.7	312.4	13.7	95.8	301.1	295.7	13.8	95.5	282.7
2-ounce	2	264.6	40.2	86.8	241.9	384.8	23.7	94.2	362.1	332.1	22.6	93.6	306.1
3-ounce	3	263.2	51.3	83.7	229.2	378.0	31.1	92.4	344.0	316.8	32.0	90.8	277.8
4-ounce	4	279.6	67.3	80.6	234.2	387.8	37.0	91.3	342.4				
5-ounce	5	265.6	82.5	76.3	208.9	410.0	42.0	90.7	353.3				
6-ounce	6	271.8	85.4	76.1	203.7	426.0	49.4	89.6	357.9				
Halved:													
2-ounce	1	200.8	20.1	90.9	189.5	302.7	14.9	95.3	291.4	303.1	12.2	96.1	290.1
3-ounce	1½	238.5	26.8	89.9	221.5	343.9	21.6	94.1	236.9				
4-ounce	2	259.2	27.2	90.5	236.5	350.9	22.8	93.9	328.2	309.0	19.7	94.0	283.0
5-ounce	2½	214.6	33.8	86.4	186.2	358.1	25.7	93.3	329.7				
6-ounce	3	236.8	37.9	86.2	202.8	367.9	29.4	92.6	333.9	295.7	31.0	90.5	256.7
Quartered:													
3-ounce	¾	205.9	16.2	92.7	197.4	315.1	11.4	96.5	306.6				
4-ounce	1	214.6	16.2	93.0	203.3	327.0	9.8	97.1	315.7	286.3	14.8	95.1	273.3
5-ounce	1¼	231.2	19.3	92.3	217.0	333.9	12.8	96.3	319.7				
6-ounce	1½	196.2	18.5	91.4	179.2	350.3	16.9	95.4	333.3				

AVERAGE YIELDS FOR TWO STATED PERIODS.

Kind of set planted.	Weight of set.	Average yield per acre, 1916 and 1917.				Average yield per acre, 1916 to 1918.			
		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.
Whole:	*Ozs.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*	*Bush.*	*Bush.*	*P. ct.*	*Bush.*
1-ounce	1	273.2	18.3	93.7	261.9	280.7	16.8	94.4	268.8
2-ounce	2	324.7	32.0	91.0	302.0	327.2	28.8	91.9	303.4
3-ounce	3	320.6	41.2	88.6	286.6	319.3	38.1	89.3	283.7
4-ounce	4	333.7	52.2	86.5	288.3				
5-ounce	5	337.8	62.3	84.4	281.1				
6-ounce	6	348.9	67.4	83.8	280.8				
Halved:									
2-ounce	1	251.8	17.5	93.5	240.5	268.9	15.8	94.5	257.0
3-ounce	1½	291.2	24.2	92.3	274.2				
4-ounce	2	305.1	25.0	92.4	282.4	306.3	23.2	93.0	282.6
5-ounce	2½	286.4	29.8	90.6	258.0				
6-ounce	3	302.4	33.7	90.0	268.4	300.1	32.8	90.2	264.5
Quartered:									
3-ounce	¾	260.5	13.8	95.0	252.0				
4-ounce	1	270.8	13.0	95.4	259.5	276.0	13.6	95.3	264.1
5-ounce	1¼	282.6	16.1	94.6	268.4				
6-ounce	1½	273.3	17.7	93.9	256.3				

[4] The data from these experiments have been more or less completely reported by C. F. Clark (one of the joint authors of this bulletin) in Colorado Station Bul. 261, pp. 26-34, January, 1921 (23), and the United States Department of Agriculture Bul. 958, pp. 20-21, August, 1921 (22). Inasmuch as these experiments were a part of the department's general study of the size of set in relation to yield and other correlated factors the facts obtained are embodied in the present report.

The results of the 1916 test, as indicated by the data presented in Table 10, show that the 2-ounce whole tubers produced the heaviest net yield of merchantable tubers, 4-ounce halved and whole and 3-ounce whole sets being close competitors. The 6-ounce quartered seed gave the lowest net yield of primes.

A study of the total yield given in Table 10 shows that the 6-ounce tubers gave the largest yield. The 5 and 4 ounce whole tubers were very close competitors with each other, in the order named. In 1917 considerably larger yields were obtained than in the preceding season. As in 1916 the 2-ounce whole tubers gave the largest net yield of primes, closely followed by the 6-ounce and 5-ounce whole seed; 3-ounce and 4-ounce whole seed gave somewhat lower yields. In total yield the 6-ounce whole seed stands at the head of the list. The 5-ounce and 4-ounce whole tubers were

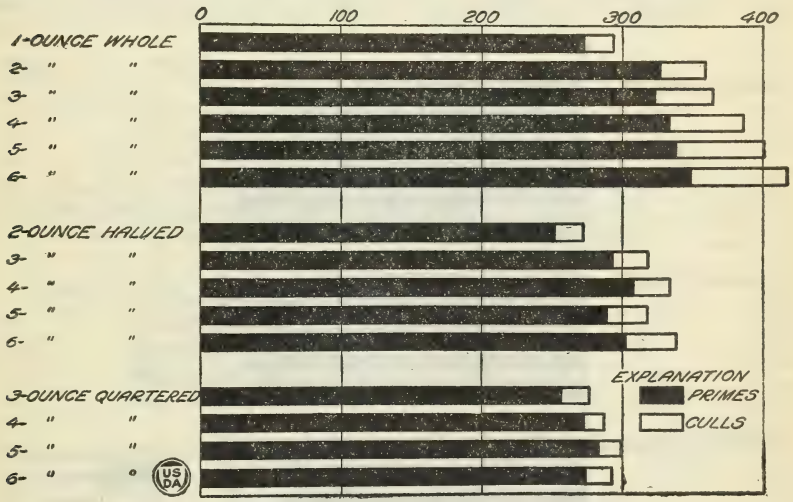

FIG. 4.—Average yields in bushels per acre from Rural New Yorker No. 2 potato sets of different weights at Greeley, Colo., in 1916 and 1917.

next in order, with the 3-ounce and 2-ounce whole tubers following. The studies in 1918 also show the heaviest net yield to have been produced from 2-ounce whole tubers, with 2-ounce halved next, followed by 4-ounce halved and 1-ounce whole sets. The average net yields for the two seasons, 1916 and 1917, place the 2-ounce whole seed first so far as the crop of primes is concerned. The 4-ounce and 3-ounce whole tubers were the next heaviest producers, while the 2-ounce halved and 3-ounce quartered sets gave least. The 6-ounce, 5-ounce, and 4-ounce whole tubers gave the largest total yields. (Fig. 4.) The averages for 1916 to 1918 show that the 2-ounce whole sets produced the highest net yield of primes, the 3-ounce whole sets second, and the 4-ounce halved sets third.

EXPERIMENTS AT JEROME, IDAHO.

Owing to unfavorable growing conditions during the seasons of 1915 and 1918 the experimental data for these two years are not included in Table 11. The data for 1916 from the Charles Downing (Idaho Rural) studies show the largest net yield from 5-ounce halved tubers. The 1-ounce whole sets were second, closely followed by 4-ounce halved, 3-ounce halved, and 3-ounce quartered sets. The 5-ounce whole tubers gave the highest total yield, 451.6 bushels. The 6-ounce whole tubers were second, with 425.4 bushels. The 3-ounce whole tubers came third and the 5-ounce halved sets fourth. In 1917, owing to a scarcity of irrigation water, all crops were very much reduced, and in consequence the outstanding differences in net yield were smaller. For example, the highest net yield, which was from 4-ounce whole tubers, was 179.2 bushels. The next three amounts show 173.7, 172.8, and 172.7 bushels per acre, produced

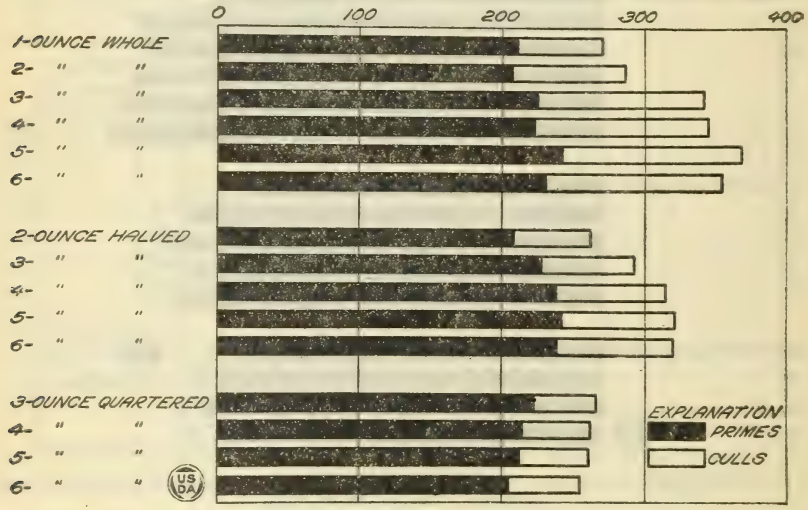

FIG. 5.—Average yields in bushels per acre from Charles Downing potato sets of different weights at Jerome, Idaho, in 1916 and 1917.

from respectively 6-ounce halved, 4-ounce halved, and 3-ounce quartered sets. These differences are too insignificant to have any value. The 4-ounce whole tubers also show the highest total yield. 313.8 bushels. The 6-ounce, 5-ounce, and 3-ounce whole tubers follow in the order named, with 286.4, 284.4, and 275.2 bushels per acre, respectively. The 2-year average of primes for 1916 and 1917 showed a net yield of 216.5 bushels from the 4-ounce halved tubers, 214.3 bushels from the 5-ounce halved, 213.5 from the 3-ounce quartered, and 211.9 from the 3-ounce halved tubers. (See fig. 5 for total yields.)

In the case of the Russet Burbank (Netted Gem) variety the data for 1916 (Table 11) show the highest net yield of primes from 4-ounce whole tubers. The 3-ounce halved sets come second, and the 5-ounce quartered, 2-ounce halved, 3-ounce quartered, and 1-ounce whole tubers show very slight differences in yield. In total yield

the 4-ounce whole tubers considerably exceeded all others, being 400.3 bushels, as compared with 380 bushels from 6-ounce whole and 350.7 from 5-ounce whole tubers. The 3-ounce whole and 6-ounce halved tubers were nearly tied for third and fourth places. In 1917 the 3-ounce whole tubers gave the largest net yield, 302.3 bushels. Their next nearest competitor, the 5-ounce whole tubers, yielded 263.7 bushels. The 4-ounce and 2-ounce whole made 259.5 and 255.6 bushels, respectively. The highest average net yield for the two seasons was obtained from 4-ounce whole tubers, closely followed by 3-ounce whole tubers. The former showed a net yield of 260.6 bushels, as against 252.3 bushels from the latter. The 3-ounce halved tubers came third with 244.6 bushels. The 2-ounce whole and 3-ounce quartered sets occupied fourth and fifth positions, respectively. In total average production of primes the 4-ounce whole tubers stand first, the 6-ounce whole second, the 3-ounce whole third, and the 5-ounce whole tubers fourth. (Fig. 6.)

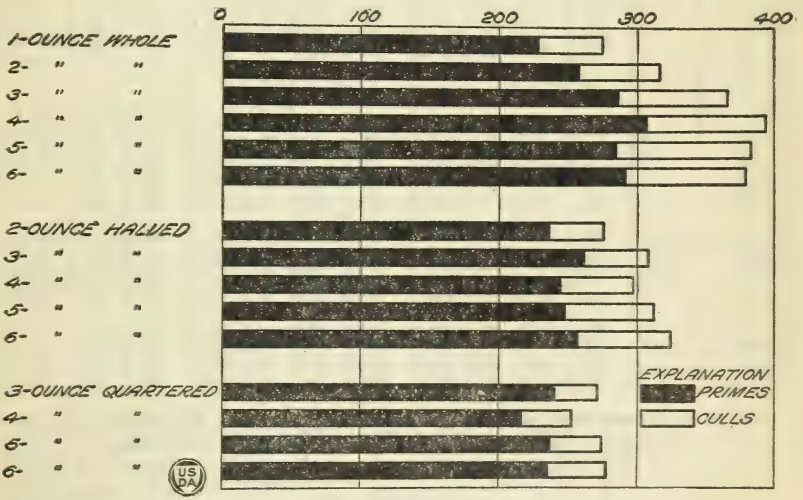

FIG. 6.—Average yields in bushels per acre from Russet Burbank potato sets of different weights at Jerome, Idaho, in 1916 and 1917.

COMPARATIVE YIELDS FROM SETS OF THE SAME WEIGHT.

A comparison of the sets of the same weight throws an interesting light on the behavior of whole, halved, or quartered sets of the same size. For convenience of study the data from comparable-sized sets tested at Presque Isle, Me., Norfolk, Va., Greeley, Colo., and Jerome, Idaho, regardless of variety, are presented in Table 12. A study of these data shows that while there are some discordant results both in primes and culls, there is on the whole a fair degree of agreement. The columns containing the average of all the data and the total yield of a given size of set show that it does not make any serious difference in the total yield whether it is whole, halved, or quartered, except possibly in the case of the 3-ounce set, in which the whole tuber proved somewhat superior to a 6-ounce halved set.

TABLE 11.—*Comparative and average yields from Charles Downing and Russet Burbank potato sets of different sizes at Jerome, Idaho, in 1916 and 1917.*

Variety and kind of set planted.	Weight of set.	Yields per acre, 1916.				Yields per acre, 1917.				Average yields per acre, 1916 and 1917.			
		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.		Primes.	Culls.	Yield of primes.	
				Actual.	Net.			Actual.	Net.			Actual.	Net.
CHARLES DOWNING.													
Whole:	*Ozs.*	*Bus.*	*Bus.*	*Per cent.*	*Bus.*	*Bus.*	*Bus.*	*Per cent.*	*Bus.*	*Bus.*	*Bus.*	*Per cent.*	*Bus.*
1-ounce	1	274.8	71.2	79.4	263.5	146.0	48.0	75.3	134.7	210.4	59.6	77.9	199.1
2-ounce	2	226.2	104.7	79.2	203.5	184.7	61.6	75.0	162.0	205.5	83.1	71.2	182.8
3-ounce	3	253.7	152.7	62.4	219.7	195.0	80.2	70.9	161.0	224.4	116.4	65.8	190.4
4-ounce	4	219.8	151.5	59.2	174.5	224.5	89.3	71.5	179.2	222.2	120.4	64.9	176.8
5-ounce	5	283.7	167.9	62.8	227.0	203.5	80.9	71.6	146.9	243.6	124.4	66.2	186.9
6-ounce	6	260.5	164.9	61.2	192.2	199.7	86.7	69.7	131.7	230.1	125.8	64.6	162.1
Halved:													
2-ounce	1	243.2	58.6	80.6	231.9	173.9	45.7	79.2	162.6	208.6	52.1	80.0	197.3
3-ounce	1½	271.8	76.8	78.0	254.8	186.0	51.4	78.4	169.0	228.9	64.1	78.1	211.9
4-ounce	2	282.8	91.5	75.6	260.1	195.5	57.1	77.4	172.8	239.2	74.3	76.3	216.5
5-ounce	2½	295.3	96.2	75.4	267.0	189.8	58.6	76.4	161.5	242.6	77.4	75.8	214.3
6-ounce	3	270.9	103.7	72.3	236.9	207.7	55.8	78.8	173.7	239.3	79.8	75.0	205.3
Quartered:													
3-ounce	¾	262.8	47.6	84.7	254.3	181.2	43.2	80.7	172.7	222.0	45.4	83.0	213.5
4-ounce	1	260.3	59.0	81.5	249.0	169.7	38.9	81.3	158.4	215.0	48.9	81.5	203.7
5-ounce	1¼	262.7	61.6	81.0	248.5	162.8	37.5	81.2	148.6	212.8	49.5	81.1	198.6
6-ounce	1½	245.0	62.8	79.6	228.0	165.4	38.3	81.2	148.4	205.2	50.6	80.2	188.2
RUSSET BURBANK.													
Whole:													
1-ounce	1	243.3	36.8	86.9	232.0	214.8	56.1	79.3	203.5	229.1	46.5	83.1	217.8
2-ounce	2	241.7	59.4	80.3	219.0	278.2	51.6	84.4	255.6	260.0	55.5	82.4	237.2
3-ounce	3	236.2	79.7	74.8	202.2	336.3	75.2	81.7	302.3	286.3	77.5	78.7	252.2
4-ounce	4	307.0	93.3	76.7	261.6	304.9	82.5	78.7	259.5	306.0	87.9	77.7	260.6
5-ounce	5	250.1	100.6	71.3	193.4	320.4	94.6	77.2	263.7	285.3	97.6	74.5	228.6
6-ounce	6	293.3	86.7	77.2	225.2	289.5	86.4	77.0	221.4	291.4	86.6	77.1	223.3
Halved:													
2-ounce	1	248.6	38.2	86.7	237.3	226.4	38.8	85.4	215.1	237.5	38.5	86.0	226.2
3-ounce	1½	269.1	41.4	86.6	252.1	254.1	52.1	83.0	237.1	261.6	46.7	84.9	244.6
4-ounce	2	248.6	45.2	84.6	225.9	242.0	63.0	79.4	219.3	245.3	54.1	81.9	222.6
5-ounce	2½	216.8	67.4	76.3	188.4	280.0	56.2	83.3	251.6	248.4	61.8	80.1	220.0
6-ounce	3	252.1	62.6	80.1	218.1	262.9	69.9	79.0	228.9	257.5	66.3	79.5	223.5
Quartered:													
3-ounce	¾	240.5	38.0	86.4	232.0	240.5	24.6	90.7	232.0	240.5	31.3	88.5	232.0
4-ounce	1	200.0	46.2	81.2	188.7	233.6	29.1	88.9	222.3	216.8	37.7	85.3	205.5
5-ounce	1¼	253.3	42.7	85.6	239.4	221.6	33.9	86.7	207.4	237.5	38.3	86.1	223.4
6-ounce	1½	243.5	41.9	85.3	226.5	229.4	37.4	85.9	212.4	236.5	39.7	85.6	219.5

TABLE 12.—*Comparative yields of prime and cull potatoes from whole and cut sets of equal weight in Virginia, Maine, Colorado, and Idaho.*

Kind of set planted.	Weight of set.	Grade of tubers.	Average yields (bushels).						
			1915 to 1918; Irish Cobbler.		1917 and 1918, Presque Isle, Me.; Green Mountain.	1916 and 1917.			All data.
			Norfolk, Va.	Presque Isle, Me.		Greeley, Colo.; Rural New Yorker No. 2.	Jerome, Idaho.		Separate.	Total.
							Charles Downing.	Russet Burbank.		
	Ounces.									
1-ounce, whole	1	Primes				271.8	210.4	232.6	238.3	279.7
		Culls				18.1	59.6	46.5	41.4	
2-ounce, halved	1	Primes	192.9	296.4	173.8	251.9	208.6	237.5	226.9	271.2
		Culls	26.4	69.2	59.3	20.2	52.1	38.5	44.3	
4-ounce, quartered.	1	Primes	234.7	288.6	197.6	270.8	215.0	216.8	237.2	276.8
		Culls	45.7	48.0	48.6	9.5	48.9	37.1	39.6	
3-ounce, halved	1½	Primes	244.2	299.8	195.4	291.3	228.9	261.6	253.5	305.7
		Culls	51.9	82.9	71.0	23.5	64.1	46.7	52.2	
6-ounce, quartered.	1½	Primes	232.7	272.0	217.8	273.3	205.2	236.4	239.6	307.0
		Culls	47.1	62.5	84.7	28.3	50.6	39.7	67.4	
2-ounce, whole	2	Primes	220.6	301.1	182.6	324.8	205.5	259.9	249.1	327.1
		Culls	69.3	108.8	121.3	29.8	83.1	55.5	78.0	
4-ounce, halved	2	Primes	258.2	313.9	189.7	305.2	239.2	245.3	258.6	326.0
		Culls	57.0	100.4	91.0	27.8	74.3	54.1	67.4	
3-ounce, whole	3	Primes	253.3	304.8	196.9	323.8	224.4	286.2	264.9	360.9
		Culls	81.5	138.1	125.8	36.5	116.4	77.5	96.0	
6-ounce, halved	3	Primes	255.8	288.1	180.6	302.4	239.3	257.5	253.9	333.9
		Culls	65.6	129.5	101.9	36.7	79.8	66.3	80.0	

RELATION OF SIZE OF SET TO NUMBER OF STEMS AND TUBERS PRODUCED.

In studying the relation of the size of set to the resultant yields a record was made of the number of stems and of tubers for each set planted. The data presented in Table 13 give the average number of stems and tubers for the various sizes of whole and cut seed used in the experiments in Maine and Virginia for the 4-year period from 1915 to 1918, inclusive. In order to facilitate the study of these data, whole, halved, and quartered seed are grouped together. A comparison of the number of stems and of tubers produced from each of these groups shows almost without exception that as the size of the set planted increases in weight, the number of stems and tubers increases and that the average number of tubers to the stem decreases. Exceptions are to be noted in the average number of tubers to the stem from the 3-ounce and 4-ounce quartered tubers in the Maine experiment. Further study of these data shows that when sets of equal weight were planted the whole tuber produced more stems and tubers than did halved sets; similarly, halved sets showed the same relation to quartered sets.

TABLE 13.—*Relation of the size of set to the average number of stems and tubers per set and of tubers per stem, in potato experiments at Norfolk, Va., and Presque Isle, Me., in stated years.*

Kind of set planted.	Weight of set.	Average number of stems and tubers per set and of tubers per stem.								
		Irish Cobbler, 1915 to 1918.						Green Mountain, Presque Isle, Me., 1917 and 1918.		
		Stems per set.		Tubers per set.		Tubers per stem.				
		Norfolk, Va.	Presque Isle, Me.	Norfolk, Va.	Presque Isle, Me.	Norfolk, Va.	Presque Isle, Me.	Stems per set.	Tubers per set.	Tubers per stem.
Whole:	*Ounces.*									
2-ounce	2	2.78	3.88	9.26	10.13	3.33	2.61	3.17	9.50	3.00
3-ounce	3	3.20	5.00	10.62	11.65	3.32	2.33	3.54	10.09	2.85
4-ounce	4	4.05	6.15	11.90	13.13	2.94	2.13	4.61	11.04	2.39
5-ounce	5							5.15	11.25	2.18
6-ounce	6	5.22	7.49	13.77	15.14	2.64	2.02	5.83	13.55	2.32
Halved:										
2-ounce	1	1.85	2.54	6.95	7.58	3.76	2.98	2.12	5.75	2.71
3-ounce	1½	2.21	3.14	7.42	8.61	3.36	2.74	2.21	6.71	3.04
4-ounce	2	2.51	3.79	8.31	9.81	3.31	2.59	2.67	7.57	2.84
5-ounce	2½							3.18	8.34	2.62
6-ounce	3	2.92	4.39	8.85	11.05	3.03	2.52	3.08	8.69	2.82
Quartered:										
3-ounce	¾	1.63	2.10	6.12	6.09	3.75	2.90	1.51	4.92	3.25
4-ounce	1	1.66	2.33	6.21	6.99	3.74	3.00	1.82	5.42	2.92
5-ounce	1¼							1.83	6.11	3.34
6-ounce	1½	1.95	2.63	7.13	7.56	3.66	2.87	1.84	7.19	3.85

In the size-of-seed studies with the Green Mountain varieties the average results obtained from the experiments in 1917 and 1918 (Table 13) show similar increases in the number of stems and tubers from each set according to its weight and whether whole, halved, or quartered. There is not, however, as uniform a decrease in the number of tubers to the stem as the size of the set increases. There is one exception in the case of the average number of stems to the set, viz, that between 5-ounce and 6-ounce halved sets. In the case of

the average number of tubers to the stem several exceptions are noted. In the first group 6-ounce whole tubers produced a greater average number of tubers to the stem than did the 5-ounce tubers. Two exceptions are found in the second group, one in which the 3-ounce and 6-ounce halved tubers showed higher figures than the 2-ounce halved and 5-ounce halved tubers, respectively. In the third group, with the exception of the 4-ounce quartered sets, there is a progressive increase rather than a decrease.

At the Greeley (Colo.) Potato Experiment Station in 1916 and 1917 studies were made of the relation of the weight of the set planted to the number of stems and tubers produced and of the average number of tubers to the stem produced by the Rural New Yorker No. 2. These data (Table 14) show a uniform increase in the average number of stems and tubers as the weight of the set increases in each of the three groups. As a rule, whole sets of the same weight as halved or quartered sets produced a larger number of stems and tubers than halved sets, and the halved sets showed the same general relation to quartered sets. The data under the heading "Average number of tubers per stem" do not show as close a correlation in the decrease of tubers per stem as the weight of the set increases.

Similar studies conducted at Jerome, Idaho, with the Charles Downing (Idaho Rural) and Russet Burbank (Netted Gem) varieties (Table 14) indicate a uniform rate of progression in the number of stems as the weight of the set increases in each of the three classes of seed, namely, whole, halved, and quartered.

TABLE 14.—*Relation of the size of set to the average number of stems and tubers per set and of tubers per stem in experiments with potatoes grown under irrigation at Greeley, Colo., and Jerome, Idaho, in 1916 and 1917.*

Kind of set planted.	Weight of set.	Average number of stems and tubers per set and of tubers per stem.								
		Rural New Yorker No. 2 at Greeley, Colo.			At Jerome, Idaho.					
					Stems per set.		Tubers per set.		Tubers per stem.	
		Stems per set.	Tubers per set.	Tubers per stem.	Charles Downing.	Russet Burbank.	Charles Downing.	Russet Burbank.	Charles Downing.	Russet Burbank.
Whole:	*Ounces.*									
1-ounce	1	1.75	4.20	2.40	2.45	2.15	6.20	5.55	2.53	2.58
2-ounce	2	2.55	6.30	2.47	3.30	3.05	9.15	6.55	2.77	2.15
3-ounce	3	3.20	7.15	2.23	4.45	3.85	11.35	7.95	2.55	2.06
4-ounce	4	3.65	7.95	2.18	4.70	4.30	11.30	9.50	2.40	2.21
5-ounce	5	4.45	9.10	2.04	5.30	4.75	13.10	9.65	2.47	2.03
6-ounce	6	5.00	10.05	2.01	6.05	5.20	13.35	9.90	2.21	1.90
Halved:										
2-ounce	1	1.80	4.00	2.22	2.10	2.15	6.85	5.20	3.26	2.42
3-ounce	1½	2.25	4.80	2.13	2.65	2.70	7.85	6.05	2.96	2.24
4-ounce	2	2.45	5.25	2.14	2.90	2.85	8.75	6.45	3.02	2.26
5-ounce	2½	2.65	5.65	2.13	3.25	3.20	9.10	6.50	2.80	2.03
6-ounce	3	3.05	6.30	2.07	3.50	3.40	9.80	7.40	2.80	2.18
Quartered:										
3-ounce	¾	1.50	3.30	2.20	1.90	1.85	6.40	4.65	3.37	2.51
4-ounce	1	1.60	3.65	2.28	1.95	1.90	6.50	4.75	3.33	2.50
5-ounce	1¼	1.85	3.90	2.11	1.95	2.15	5.80	5.15	2.97	2.39
6-ounce	1½	1.95	4.15	2.13	2.00	2.35	6.85	5.40	3.43	2.29

In the case of the average number of tubers per set planted, two exceptions are noted in the Charles Downing variety in which

4-ounce whole seed shows a lower average number of tubers than that from 3-ounce whole sets. The second exception occurs between 5-ounce quartered sets, which show a lower average number than the 3-ounce and 4-ounce sets.

The Russet Burbank data show a fairly uniform increase in the number of tubers as the weight of the set increases.

Comparison of the average number of tubers to the stem shows a greater lack of agreement than in the other two sets of data, but in general it is evident that the number of tubers per stem are inversely proportional to the size of the set. These results coincide with those published in 1892 by Arthur (*10*) in which it was found that as the number of stems per set increased there was a progressive diminution in the average number of tubers to the stalk.

A summary of the foregoing data of the five varieties studied, as presented in Table 15, shows with but one exception that as the weight of the set increases, whether of whole, halved, or quartered seed, there is a progressive increase in the average number of stems to the set. The exception noted is in the 6-ounce halved sets of the Green Mountain variety, which gave a slightly smaller number of stems than the 5-ounce halved sets.

A comparison of the average number of tubers produced to the set by each of the five varieties shows that with but two exceptions the number of tubers increases with the weight of the set, provided such comparison is made separately between whole, halved, and quartered sets. The two exceptions noted relate to the Charles Downing variety. The 4-ounce whole sets of this show a slightly smaller number of tubers than the 3-ounce whole sets and the 5-ounce quartered sets smaller than the 4-ounce quartered sets.

TABLE 15.—*Relation of the size of set to the average number of stems and tubers per set of five varieties of potatoes as grown in Virginia, Maine, Colorado, and Idaho in stated years.*

Kind of set planted.	Average number of stems per set.						Average number of tubers per set.					
	1915 to 1918; Irish Cobbler.		1917 and 1918, Presque Isle, Me.; Green Mountain.	1916 and 1917.			1915 to 1918; Irish Cobbler.		1917 and 1918, Presque Isle, Me.; Green Mountain.	1916 and 1917.		
	Norfolk, Va.	Presque Isle, Me.		Greeley, Colo.; Rural New Yorker No. 2.	Jerome, Idaho.		Norfolk, Va.	Presque Isle, Me.		Greeley, Colo.; Rural New Yorker No. 2.	Jerome, Idaho.	
					Charles Downing.	Russet Burbank.					Charles Downing.	Russet Burbank.
Whole:												
1-ounce	------	------	------	1.75	2.45	2.15	------	------	------	4.20	6.20	5.55
2-ounce	2.78	3.88	3.17	2.55	3.30	3.05	9.26	10.13	9.50	6.30	9.15	6.55
3-ounce	3.20	5.00	3.54	3.20	4.45	3.85	10.62	11.65	10.09	7.15	11.35	7.95
4-ounce	4.05	6.15	4.61	3.65	4.70	4.30	11.90	13.13	11.04	7.95	11.30	9.50
5-ounce	------	------	5.15	4.45	5.30	4.75	------	------	11.25	9.10	13.10	9.65
6-ounce	5.22	7.49	5.83	5.00	6.05	5.20	13.77	15.14	13.55	10.05	13.35	9.90
Halved:												
2-ounce	1.85	2.54	2.12	1.80	2.10	2.15	6.95	7.58	5.75	4.00	6.85	5.20
3-ounce	2.21	3.14	2.21	2.25	2.65	2.70	7.42	8.61	6.71	4.80	7.85	6.05
4-ounce	2.51	3.79	2.67	2.45	2.90	2.85	8.31	9.81	7.57	5.25	8.75	6.45
5-ounce	------	------	3.18	2.65	3.25	3.20	------	------	8.34	5.65	9.10	6.50
6-ounce	2.92	4.39	3.08	3.05	3.50	3.40	8.85	11.05	8.69	6.30	9.80	7.40
Quartered:												
3-ounce	1.63	2.10	1.51	1.50	1.90	1.85	6.12	6.09	4.92	3.30	6.40	4.65
4-ounce	1.66	2.33	1.82	1.60	1.95	1.90	6.21	6.99	5.42	3.65	6.50	4.75
5-ounce	------	------	1.83	1.85	1.95	2.15	------	------	6.11	3.90	5.80	5.15
6-ounce	1.95	2.63	1.84	1.95	2.00	2.35	7.13	7.56	7.19	4.15	6.85	5.40

A more striking comparison of the two sets of data relating to the Irish Cobbler in Virginia and Maine is found by placing in parallel columns (Table 16) the average performance of 300 sets, during the 4-year period from 1915–1918 as regards the total number of stems and tubers. The average number of stems and tubers produced by the individual set is also given. A study of these data shows, as in the data previously presented, a distinct and progressive ratio of increase of both stems and tubers by the large over the small set and of the whole tubers over the cut seed. One of the most interesting features of these data is found in a comparison of the relative number of stems and tubers produced from sets of the same size in the Virginia and Maine experiments. Those grown in Maine averaged 42 per cent more stems but not quite 12 per cent more tubers than those grown in Virginia. This difference in behavior may have been due to the longer period of storage to which the seed planted in Maine was subjected. The average planting period at the Virginia Truck Experiment Station was from February 27 to March 7, whereas the planting at Presque Isle, Me., occurred usually between May 15 and 25, or from 8 to 10 weeks later. The Virginia experiment, in other words, was planted with seed stock which had just completed its deep-rest period; whereas the stock planted in Maine was in a more active stage physiologically, which induced a larger number of eyes to germinate and produce stems. There is, of course, another factor, that of the temperature of the soil. During March it is usually too cool to stimulate the development of sprouts from weak or more or less dormant eyes.

TABLE 16.—*Relative influence of the size of set on the production of stems and tubers, as shown by the record of 300 plants of the Irish Cobbler potato in Virginia and Maine for the 4-year period, 1915-1918.*

Kind of set planted.	Weight of set.	Norfolk, Va.				Presque Isle, Me.			
		Total number.		Average per set.		Total number.		Average per set.	
		Stems.	Tubers.	Stems.	Tubers.	Stems.	Tubers.	Stems.	Tubers.
Whole:	*Ounces.*								
2-ounce	2	833	2,778	2.78	9.26	1,162	3,040	3.87	10.13
3-ounce	3	959	3,174	3.20	10.58	1,500	3,495	5.00	11.65
4-ounce	4	1,216	3,571	4.05	11.90	1,845	3,938	6.15	13.13
5-ounce	5	1,378	3,912	4.59	13.04	2,010	4,204	6.70	14.01
6-ounce	6	1,566	4,131	5.22	13.77	2,239	4,546	7.46	15.15
Halved:									
2-ounce	1	554	2,104	1.85	7.01	418	2,250	1.39	7.50
3-ounce	1½	663	2,227	2.21	7.42	942	2,583	3.14	8.61
4-ounce	2	753	2,492	2.51	8.31	1,137	2,945	3.79	9.82
5-ounce	2½	824	2,674	2.75	8.91	1,242	3,113	4.14	10.38
6-ounce	3	876	2,658	2.92	8.86	1,318	3,317	4.39	11.06
Quartered:									
3-ounce	¾	489	1,571	1.63	5.24	630	1,827	2.10	6.09
4-ounce	1	497	1,862	1.66	6.21	697	2,098	2.32	6.99
5-ounce	1¼	524	1,999	1.75	6.66	739	2,199	2.46	7.33
6-ounce	1½	584	2,141	1.95	7.14	789	2,113	2.63	7.04

FREQUENCY CORRELATIONS OF STEMS.

A study of the occurrence of the same number of stems from sets of given sizes based on the average performance of the number of Irish Cobbler plants studied at the Virginia Truck Experiment

Station, for the years 1915 to 1918, inclusive, shows a marked correlation with respect to both the weight and character of set used and the stems produced.

TABLE 17.—*Stem-frequency correlations of Irish Cobbler potatoes at the Virginia Truck Experiment Station in the 4-year period, 1915–1918.*

Kind of set planted.	Weight of set.	Number of stems (frequency of the same number of stems per set).											
		1	2	3	4	5	6	7	8	9	10	11	12
Whole:	*Ounces.*												
2-ounce	2	29.1	100.0	102.0	51.8	14.1	1.0	2.0					
3-ounce	3	11.3	71.5	110.3	73.0	24.2	7.4	1.9	0.4				
4-ounce	4	5.2	33.1	66.2	85.9	67.5	32.2	8.2	1.3	0.4			
5-ounce	5	1.2	20.5	43.4	82.5	75.3	49.3	19.3	7.9	.6			
6-ounce	6	1.9	9.8	27.2	58.1	74.3	68.7	41.1	13.6	3.8	1.1		0.4
Halved:													
2-ounce	1	100.0	152.3	41.2	6.5								
3-ounce	1½	65.4	138.9	69.7	21.2	3.5	.9	.4					
4-ounce	2	41.5	120.5	93.5	34.5	8.9	.7	.4					
5-ounce	2½	17.4	111.2	117.9	39.1	12.6	1.8						
6-ounce	3	22.5	88.8	104.3	63.8	15.5	5.1						
Quartered:													
3-ounce	¾	139.2	136.7	21.1	2.4	.6							
4-ounce	1	146.3	113.6	37.1	3.0								
5-ounce	1¼	127.4	128.7	36.1	7.8								
6-ounce	1½	98.3	133.4	55.8	11.4	1.1							

These data, as presented in Table 17, show a relatively uniform progression in stem frequency in whole sets. The greatest frequency in 2-ounce whole sets, while actually shown as three stems, might readily be regarded as falling between two and three stems. In 3-ounce whole sets the greatest frequency occurred at three stems. The 4-ounce and 5-ounce whole sets produced four stems most frequently, while in 6-ounce whole tubers the greatest frequency was at five stems.

TABLE 18.—*Stem-frequency correlation of Irish Cobbler potatoes at Presque Isle, Me., in the 4-year period, 1915–1918.*

[The greatest frequency occurrence of whole tubers is marked in each case with a star (*).]

Kind of set planted.	Weight of set.	Number of stems (frequency of the same number of stems per set).														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Whole:	*Ounces.*															
2-ounce	2	5.7	42.6	*83.7	82.0	48.4	22.2	8.7	4.7	1.7	0.3					
3-ounce	3	1.4	14.5	44.9	*71.5	59.4	49.3	33.7	14.9	4.7	4.4	1.3				
4-ounce	4		2.4	19.8	43.3	56.1	*58.5	48.0	35.6	17.5	11.8	5.7	0.7	0.3		0.3
5-ounce	5	.5	1.0	8.0	27.0	41.0	*65.0	63.0	43.0	29.0	14.5	4.0	3.0	1.0		
6-ounce	6		.7	2.3	15.4	37.5	45.1	*59.2	52.2	36.1	28.1	13.7	5.0	3.7	0.7	.3
Halved:																
2-ounce	1	40.4	118.5	36.1	6.7	1.0										
3-ounce	1½	14.5	77.7	110.5	61.5	25.7	6.8	2.3	.3	.7						
4-ounce	2	5.0	42.8	82.5	92.4	48.5	18.4	6.7	3.7							
5-ounce	2½	4.0	27.8	65.2	90.4	68.2	29.3	12.1	3.0							
6-ounce	3	1.3	14.4	62.4	96.3	64.8	39.6	16.5	4.0	.7						
Quartered:																
3-ounce	¾	80.1	128.4	75.1	14.6	1.4	2.4									
4-ounce	1	50.2	141.9	78.2	22.1	6.3	.4	.9								
5-ounce	1½	39.3	129.4	92.1	33.2	4.5	1.5									
6-ounce	1½	25.5	128.2	90.6	44.6	9.7	1.4									

In the case of halved seed the greatest frequency was at two stems for 2-ounce, 3-ounce, and 4-ounce sets and at three stems for 5-ounce and 6-ounce sets.

For quartered sets the greatest frequency was at one stem for 3-ounce and 4-ounce sets and two stems for 5-ounce and 6-ounce sets.

A similar study of the behavior of Irish Cobbler potatoes grown in Maine indicates a general tendency of comparable sets of different

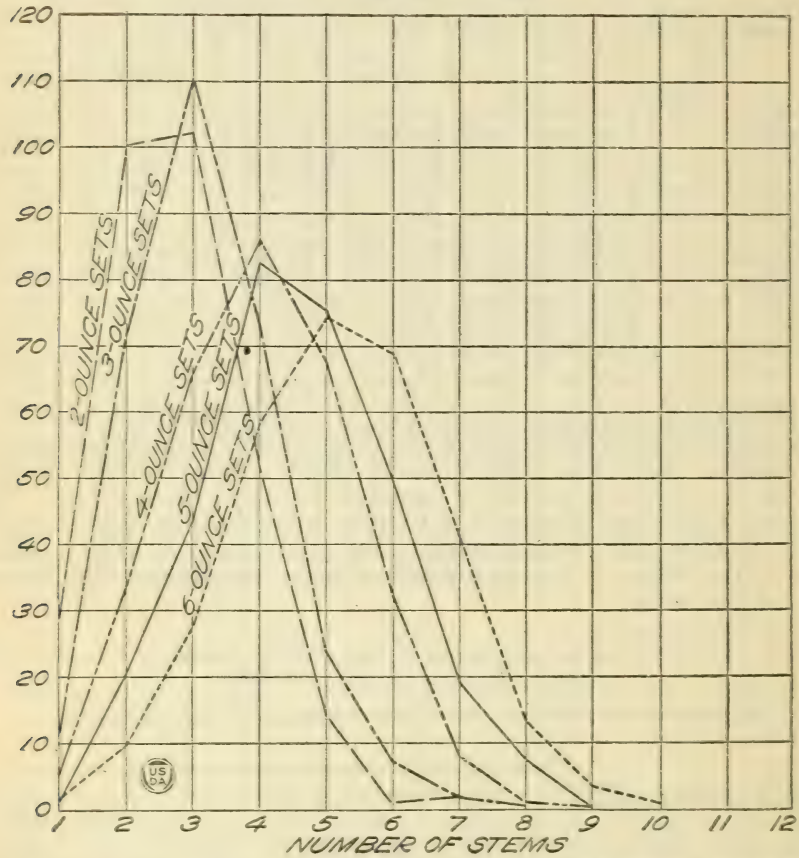

FIG. 7.—Irish Cobbler stem-frequency correlations from whole sets grown at the Virginia Truck Experiment Station, 1915 to 1918, inclusive.

weights to show like correlations of stem frequency. For example, the data for whole tubers as given in Table 18 show that the greatest frequency in 2-ounce whole seed occurred at three stems, in 3-ounce sets at four stems, in 4-ounce and 5-ounce sets at six stems, and in 6-ounce sets at seven stems.

In the case of halved sets, the 2-ounce sets showed the greatest frequency at two stems, the 3-ounce at three stems, and the 4-ounce, 5-ounce, and 6-ounce halved sets at four stems.

Quartered sets from 3, 4, 5, and 6 ounce tubers showed that the greatest frequency occurred at two stems.

The accompanying diagrams (figs. 7 to 12) present these data in a more striking manner than the tabulations.

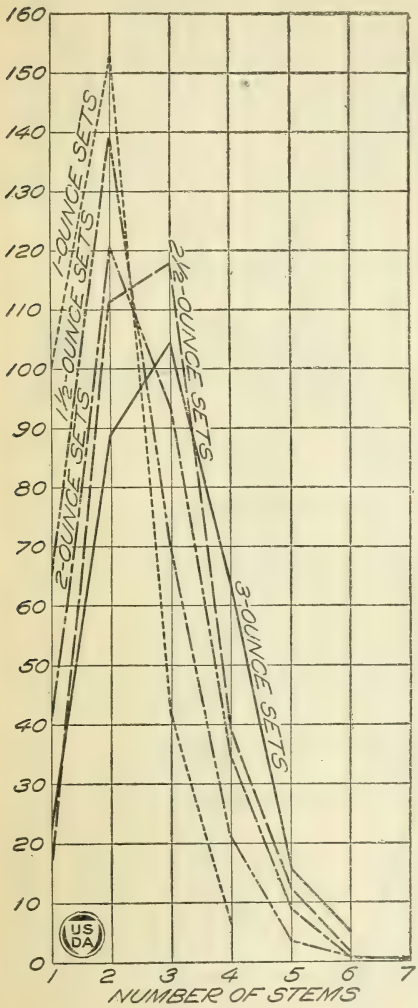

FIG. 8.—Irish Cobbler stem-frequency correlations from halved sets grown at the Virginia Truck Experiment Station, 1915 to 1918, inclusive.

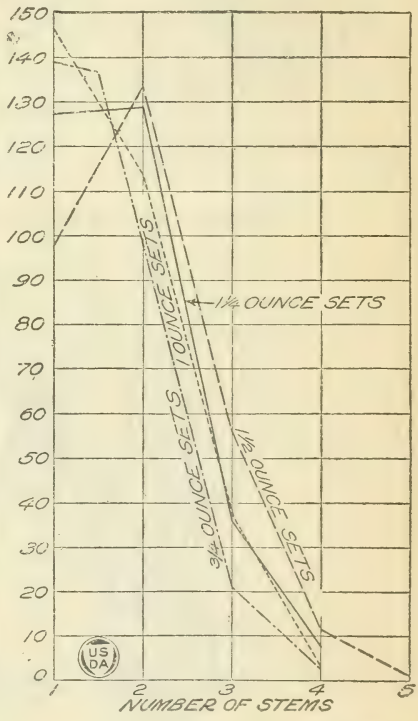

FIG. 9.—Irish Cobbler stem-frequency correlations from quartered sets grown at the Virginia Truck Experiment Station, 1915 to 1918, inclusive.

SUMMARY.

The use of whole or of cut sets for seed in potato production has served as a subject of investigation for at least a century and a half and is still a moot question. A critical study of the literature on the subject leaves the impression that much of the data presented is inconclusive. It also serves to convince the reader that much depends upon the manner in which the experiment was planned and executed whether whole or cut sets gave the most profitable yield.

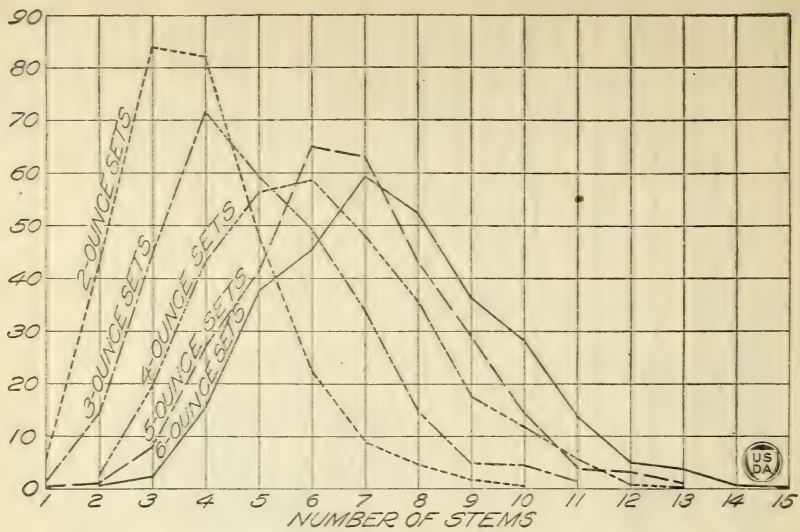

FIG. 10.—Irish Cobbler stem-frequency correlations from whole sets grown at Presque Isle, Me., 1915 to 1918, inclusive.

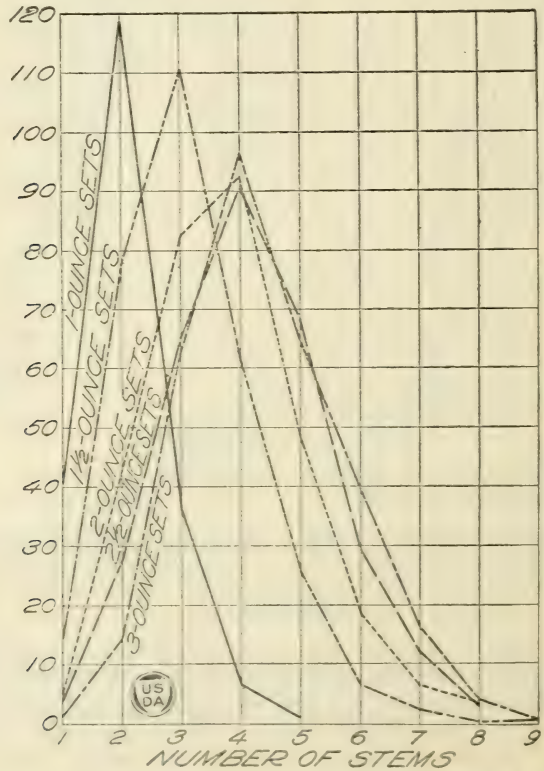

FIG. 11.—Irish Cobbler stem-frequency correlations from halved sets grown at Presque Isle, Me., 1915 to 1918, inclusive.

The successful determination of the most profitable size of set to use and whether it should be planted whole or cut primarily involves a careful study of the proper spacing to give to each size of set in order to obtain the maximum yield.

Departmental studies covering several years show rather conflicting results, so far as the yield of primes, or marketable potatoes, is concerned.

The data clearly show that seasonal conditions have a very definite influence upon yield, particularly with respect to the size of the tubers. Abundance of moisture and plant food throughout the growing season insures a maximum crop from whole and large-sized cut sets; whereas lack of these two prerequisites favors medium-sized

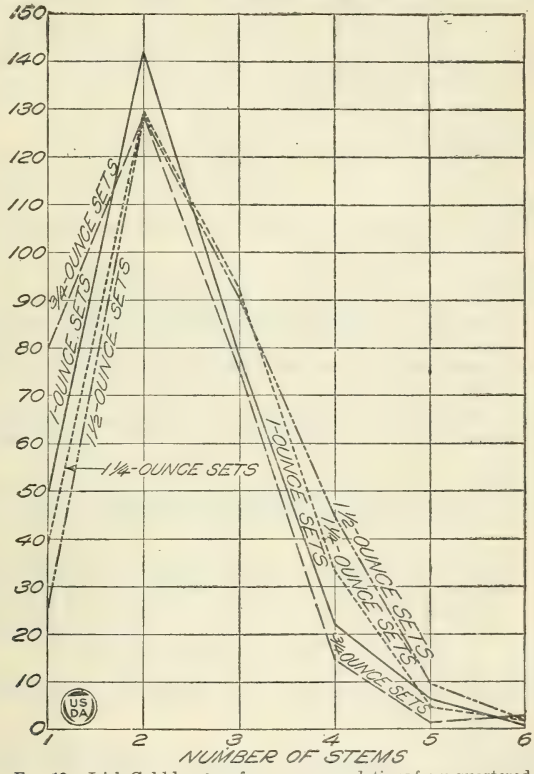

FIG. 12.—Irish Cobbler stem-frequency correlations from quartered sets grown at Presque Isle, Me., 1915 to 1918, inclusive.

cut sets, because fewer tubers are produced, and in consequence they have a better chance to reach marketable size.

There is a definite relation between the size of the set used and the number of stems and tubers produced to the set.

A study of stem-frequency correlation shows that as the weight of whole seed increases from 2 to 6 ounces the stem frequency shifts from three stems in the case of 2-ounce sets to seven stems in the case of 6-ounce sets. Halved seed shifts from two stems to four stems. Quartered sets on the other hand, whether from 3, 4, 5, or 6 ounce tubers, show that the greatest stem frequency falls in the 2-stem column in the Presque Isle, Me., data. In the Virginia data whole sets shift from 3 to 5 stems, halved sets from 2 to 3 stems, and quartered sets from 1 to 2 stems.

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